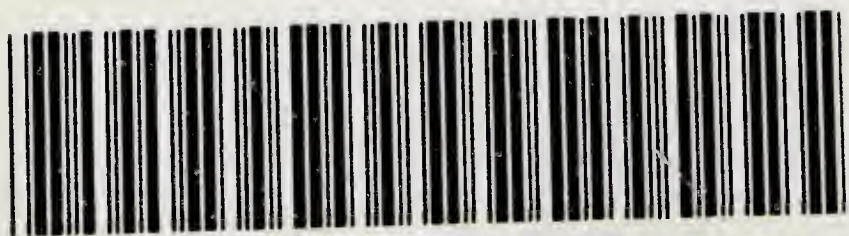


INJURIES AND DISEASES
OF THE KNEE-JOINT

SIR WILLIAM BENNETT.



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INJURIES AND DISEASES

OF

THE KNEE-JOINT

CONSIDERED FROM

THE CLINICAL ASPECT

BY

SIR WILLIAM BENNETT, K.C.V.O., F.R.C.S.

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AUTHOR'S NOTE

THE following pages deal with the purely personal experience of one who has had somewhat extensive opportunities for becoming familiar with the subject concerned, the main object being, whilst carefully avoiding the production of anything like a systematic treatise, to afford in a practical way information of a kind which may prove useful to those who have as yet had less experience than the writer, who would have been glad to have had it at his disposal some years ago.

W. H. B.

CHESTERFIELD STREET,
MAYFAIR.

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INJURIES AND DISEASES OF THE KNEE-JOINT

CHAPTER I

THE NORMAL KNEE

ALTHOUGH a complete description of the normal knee is unnecessary, certain points in connection with it are of so much moment from the clinical standpoint that a reference to them can hardly be considered out of place, especially as their importance does not seem to be always recognised. The knee-joint, the largest in the body, but, having regard to the strain constantly thrown upon it, the weakest mechanically, although technically classified as an arthrodial or gliding joint of a very complicated kind, may, by reason of the very slight amount of perceptible lateral and rotatory movement in the ideal limb, for practical purposes be regarded as little more than

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a mere hinge. In all subjects there is, however, a certain amount of internal and external rotation of the tibia upon the femur, which is well marked in the semi-flexed position, but generally almost imperceptible in complete extension of the limb. In the perfect anatomical state there is in the fully extended position no lateral movement, nor is it possible by means of any ordinary force to bend the leg outwards or inwards upon the thigh to an appreciable degree. In many subjects, however, the ideal condition is departed from, and some lateral movement and bending of the kind referred to are present. In such cases the inward bending (adduction) of the leg upon the thigh at the knee is the more easily effected, excepting in women, in whom, if the natural genu valgum passes beyond the normal degree, outward bending (abduction) is generally the more easy to demonstrate, the excess on the side of the inward bend being largely due to its occurring at the expense of a yielding structure—the ilio-tibial band—a very important point, as will presently be shown.

The amount of excessive movement in a knee-joint which may be regarded as abnormal is a question of degree and of individual peculiarity. It may for clinical purposes be held, if the freedom of movement in all directions be equal in the two knees, that in the absence of obvious signs of disease or pathological weakness, the condition is

peculiar to the individual and normal so far as he or she is concerned. Moreover, it will generally be found if the looseness of the knee-joint is only a peculiarity that other joints, especially the wrists, have the same characteristics. The importance of bearing in mind that symmetrical looseness of the knee-joints may be frequently met with in perfectly sound subjects is too obvious to need comment. Unilateral hyper-mobility should, on the other hand, clearly suggest either disease or some physical defect.

In the ideal lower limb, the subject standing fully erect and being viewed from the side, a line dropped vertically through the middle of the acetabulum to the foot will cross the outer edge of the patella and impinge upon the metatarso-phalangeal joints of the fourth and fifth toes, but in a considerable number of people, mostly males, the normal extension is in fact hyper-extension, in some cases to such a degree as to come within a measurable distance of what is clinically called *genu recurvatum*, without in any way affecting the strength of the individual. This peculiarity of hyper-extension is generally due to excessive length of the anterior crucial ligament, which is the main check in limiting extension of the knee. Here, again, the deviation from the ideal condition may, when occurring in both knees, be considered merely as a peculiarity, but if unilateral it should not be so regarded. Again, certain subjects in

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standing do not apparently place the lower limbs in full extension, slight flexion at the knee when fully erect being with them the normal condition—if it is symmetrical. In the same way deviations from

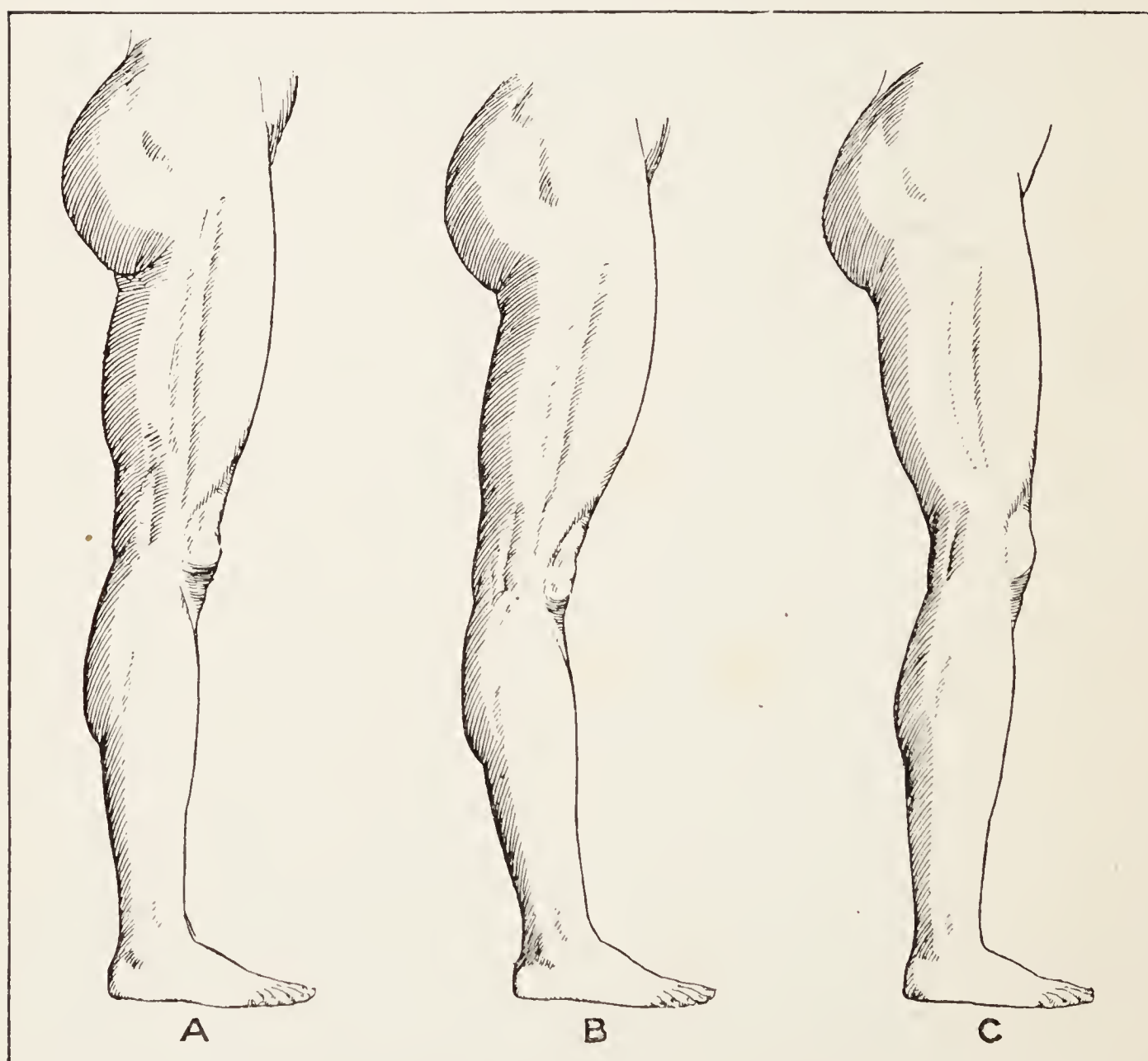


FIG. 1.—Showing (A) the usual position of the lower limb in extension, and slight peculiarities in hyperextension (B), and in flexion (C), which are natural to some subjects.

the ideal contour of the lower limbs, when viewed from the front, constantly occur in perfectly sound subjects, in whom such deviations (*e. g.* slight in-bending or slight bowing-out of the knee), when symmetrical, may be regarded as mere peculiarities,

which are sometimes so marked (as, for example, frequently in stable-boys) that it is difficult to say when the limit beyond the possible normal is reached and the abnormal begins. The crucial point of this particular matter, then, is that deviations from ideal normality either in mobility or shape, provided that they are symmetrical, may be regarded as peculiarities only unless there are obvious indications of disease, as, for an example, in the symmetrical malformation of rickets. It should, however, be borne in mind that these deviations from the true normal when symmetrical are prone to be somewhat more obvious on the right side, excepting in left-handed subjects, when the reverse is often the case.

The ilio-tibial band.—The integrity of the knee-joint, so far as its perfect functions are concerned, is largely dependent on this structure, which, by exercising an ever-vigilant traction upon the capsule of the joint and its connections, is almost the sole means by which excessive lateral movement in the knee-joint is prevented. The ligaments, however strong and normal, leave a large margin of undesirable mobility which is prevented by the ilio-tibial band; any condition, therefore, which interferes with the integrity of it, or weakens the muscles which control its action, indirectly leads to weakening of the knee-joint. This structure, as shown by the diagram (Fig. 2) is the very strong specialised outer portion of the deep fascia of the thigh which,

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at its upper end, after coming down from the crest of the ilium, receives the insertion of the greater portion of the gluteus maximus and the whole of the tensor fasciæ femoris—two very strong muscular arrangements entering the ilio-tibial band obliquely

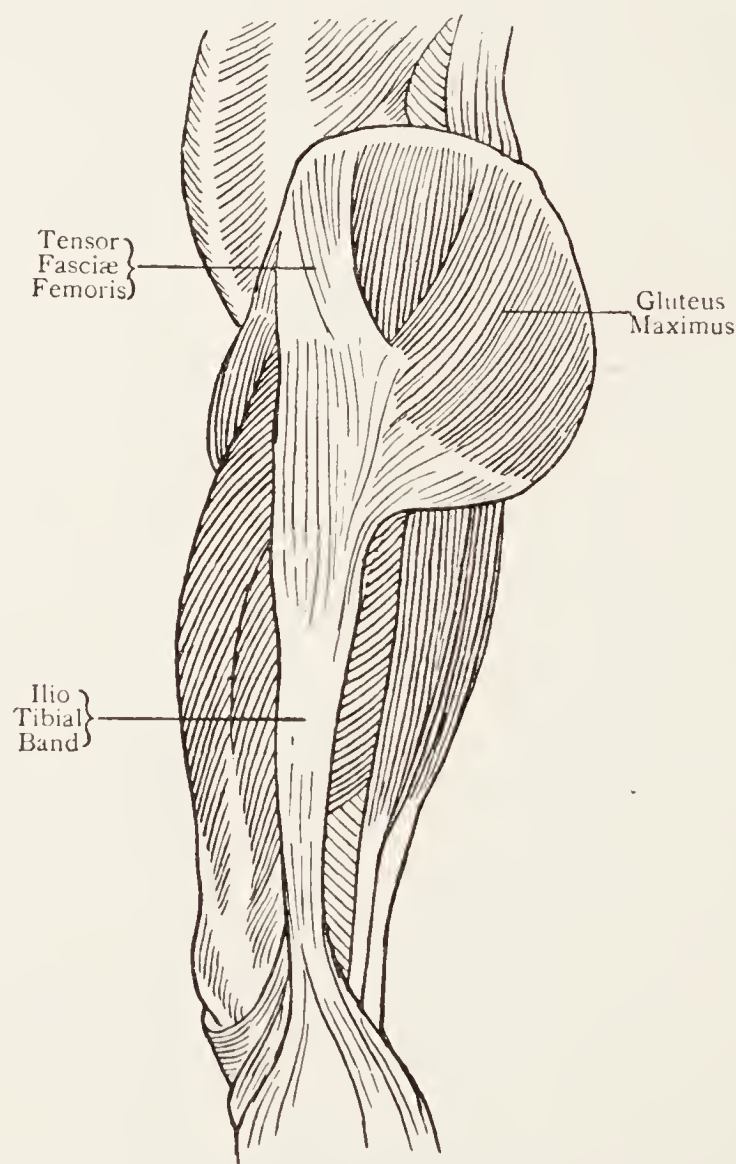


FIG. 2.—Showing the general arrangement of the ilio-tibial band.

from opposite points—which by their combined action exercise an immensely strong traction upon it in a vertical direction; below, the band becoming as it descends more concentrated and thick, is inserted into the outer side of the head of the tibia, having previously sent off expansions which are attached to

the various bony prominences about the knee, and after reinforcement by expansions from the vasti muscles become indistinguishable from the capsule of the joint. The relation of the ilio-tibial band to the tonicity of the knee-joint is the same as that of the tendons passing from the leg to, and under, the tarsus to the integrity of the arch of the foot, and it would be just as rational to attempt to cure (in the proper sense of the word) flat-foot by ignoring the treatment of the muscles and tendons concerned, as to treat hyper-mobility of the knee-joint without taking into consideration the condition of the muscles controlling the ilio-tibial band, for although certain tendons, notably those of the semi-membranosus, the biceps and the popliteus, have some effect in steadying the joint, this is too slight to be of much account if the ilio-tibial band be inefficient.

The synovial membrane of the knee-joint, the most extensive in the body, being included in a capsule which is not of uniform strength, is liable, under the pressure of long-existing or constantly recurring effusion into it, to protrude in certain parts and to become irregular in shape, the part of the capsule which most commonly bulges first being that immediately above and to the outer side of the patella. Irregularity of contour, then, of the capsule, and with it, of course, the synovial membrane when distended, may be taken to indicate chronic or recurrent effusion of long standing. In some cases

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under such circumstances definite extension processes from the synovial membrane may occur quite independently of the normal bursæ in communication with the joint. The situation of some of the normal bursæ is a matter of importance. In front there are

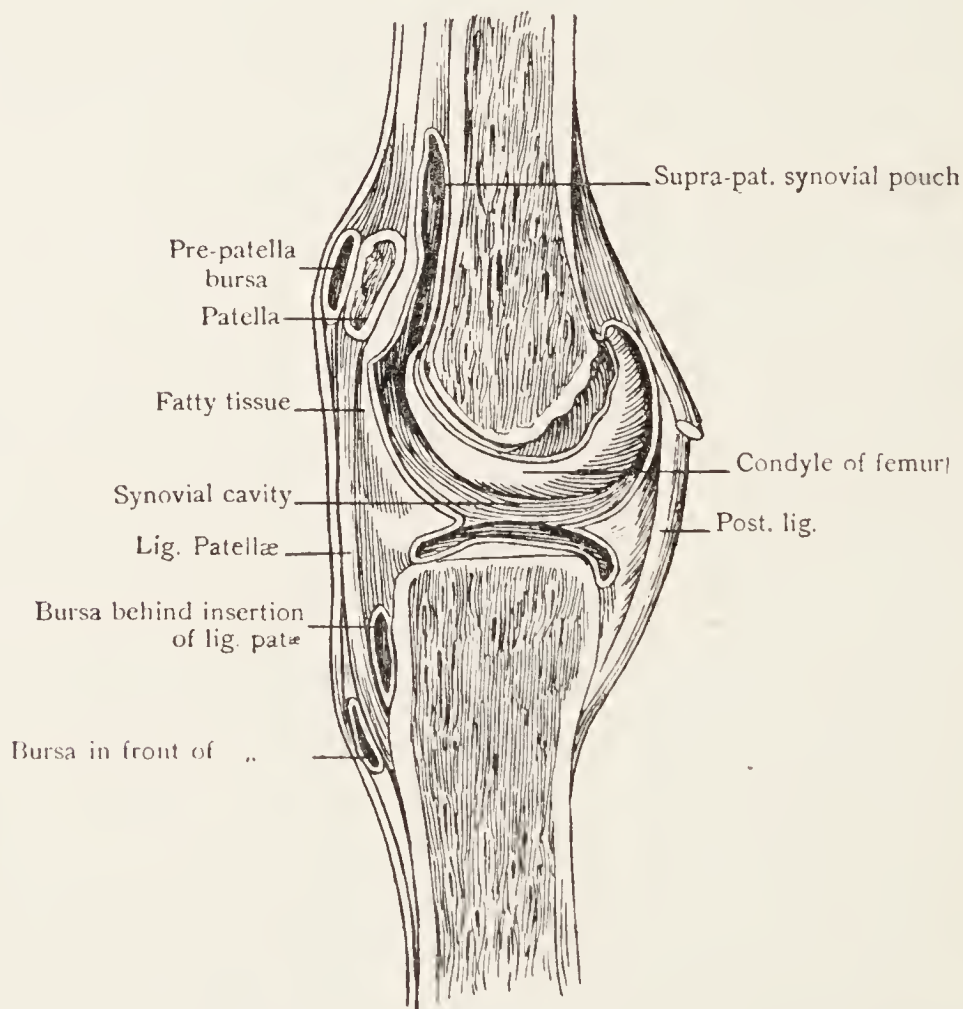


FIG. 3.—Showing the situation of the independent bursæ about the knee-joint. The position of the patella has been placed too high. The bursæ are represented as being somewhat distended for purposes of clearness.

three—one over the lower part of the anterior surface of the patella, a second between the ligamentum patellæ and the upper end of the tibia, and a third under the skin over the tubercle of the tibia (Fig. 3). Occasionally the extension of the synovial membrane upwards beyond the patella—the sub-crureal pouch

—is shut off from the joint, and thus may form a fourth bursa, but there is nearly always, in such circumstances, a small communication between it and the general joint cavity. The importance of having in mind the arrangement of these bursæ lies in the fact that it is possible in wounds of any one of them that synovial fluid may escape without the knee-joint having been opened. Escape of synovial fluid through a wound remote from the situation of the three normally independent bursæ may be taken to mean a wound of the joint itself, and, speaking generally, a wound of the sub-crureal pouch may be taken to mean a wound of the joint, as complete obliteration of the communication between it and the joint is so rare. The bursæ, of which there are nine or ten, in relation with the lateral and posterior aspects of the knee are of minor importance, excepting those which communicate with the joint and hence participate in the results of its injury or disease. These communicating bursæ are usually the following: one beneath the outer head of the gastrocnemius, one beneath the tendon of the popliteus and one beneath the semi-membranosus tendons, the last being the most important, as it is the structure generally concerned in the formation of the very common condition known clinically as a “popliteal bursa.” With reference to the question of the vulnerability of the synovial membrane of the knee-joint, it should be noted that on the anterior aspect—that most exposed to injury—

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the depth of the synovial membrane from the surface differs greatly in different parts; it is nearest the surface at each side of the patella, whilst behind the ligamentum patella it lies a considerable distance from the skin, from which it is separated by a thick pad of embryonic and fatty tissue.

The position of the patella.—The patella, a true sesamoid bone, contributes to the perfect working of the knee-joint, although it is not absolutely essential to it, as has been shown in cases in which the bone has been lost by necrosis or by sub-periosteal removal without any manifest impairment of the utility of the joint. Usually considered to be a strong general protection to the joint on the anterior aspect, too much reliance must not be placed upon it in this respect in connection with wounds from sharp instruments, pieces of glass, etc., since in all positions of the joint, as a reference to Fig. 3 and Plate I will show, a considerable area of the synovial membrane is vulnerable above and below the patella, as well as, of course, on each side of it. The aspect of the joint in front immediately above the articular edge of the tibia, although apparently vulnerable, is less so than would at sight appear, in consequence of the considerable space between the skin and the synovial membrane occupied by condensed fatty tissue. The most accessible parts of the joint to wounds are immediately above and immediately below the patella, because at those points the synovial membrane

PLATE 1.

FIG. 1.



FIG. 2.



FIGS. 1 AND 2.—X-ray photograph showing the position of the patella in extension and flexion.

approaches most nearly to the skin on the aspect of the limb most exposed to injury. Posteriorly the joint cavity in flexion may be said to be out of harm's way; in extension the synovial cavity in relation with the condyles comes within a vulnerable distance of the skin, but in this situation a wound of the joint may be a matter of secondary importance in consequence of coincident damage to large vessels and nerves. The difference in the relation of the patella to the condyles, in extension, semi-flexion and flexion is a matter of some moment, especially in connection with the point of entry of penetrating wounds. Supposing, for example, an instrument to have entered the joint immediately below the patella in flexion of the knee; the entrance wound, if the knee were extended, would be over the anterior surface of the patella, which, unless careful inquiries had been made as to the position of the limb at the time of injury, might lead to a delusive sense of security on the supposition that a wound of the joint had been prevented by the instrument impinging on the patella. There are, in addition to the patella, frequently two, sometimes three, sesamoid bones in relation with the knee, one in the popliteus tendon and one in the outer head of the gastrocnemius, just below its point of origin; a third is very rarely met with in the inner head of the gastrocnemius. These accessory sesamoids are small and of little clinical importance, but a knowledge of their existence is

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necessary in order to avoid misinterpretation of their appearance when seen in X-ray photographs (Plate III). A case, for example, came under the writer's notice in which, after a superficial wound over the knee from a bullet, the sesamoid bone in the popliteus was at first regarded as a foreign body—a mistake which could hardly have happened if those concerned had been familiar with the occasional occurrence of this structure.

CHAPTER II

ACUTE EFFUSION INTO THE KNEE-JOINT

I. AFTER INJURY.

It is commonly held that distension of the joint following immediately upon injury is due to blood ; if coming on after an interval to synovial effusion. Speaking generally this is true, but exceptions are met with ; for example, I have on several occasions withdrawn pure synovial fluid from the knee-joint within a few hours of the injury immediately upon which rapid swelling occurred, and I have, on the other hand, removed what was practically pure blood with only the slightest possible mixture of synovial fluid from a joint which, although painful, did not commence to swell until three days after an accident.

Acute distension from hæmorrhage.—The distinguishing character of this is, as has already been said, the immediate occurrence of the distension after injury. The severity or nature of the injury does not seem to necessarily bear any relation to the degree of distension, as a very slight blow may be followed by as marked effusion as a wrench, dislocation, or other

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violent injury, although naturally, as a rule, the gravest results follow the severest injuries. In young males, if the extravasation into the joint follows a trivial injury, the possibility of the existence of hæmophilia must not be lost sight of. Heavy blows, it should be remembered, are apt to cause much bruising and extravasation around the joint; the effusion into the joint itself may be comparatively small and perhaps synovial only.

The pain is at first frequently less marked in cases in which the injury has been most severe, especially if it be a blow, in consequence of the parts being numbed by "shock"; the reactionary pain, however, is then greater. As the distension reaches its full degree the limb assumes a position midway between extension and semi-flexion, because the capacity of the articulation is greatest in that position. In every case of this kind the possibility of fracture must, of course, be borne in mind, although the gross signs of it may be absent. Manipulation may be too painful to admit of any adequate examination without an anæsthetic; moreover, in any case the unnecessary manipulation of a bleeding joint is to be avoided, hence the X rays, when available, should always be employed.

The existence of fracture or dislocation having been eliminated, the question of treatment arises. In the absence of fracture, fixation by splints is unnecessary as well as uncomfortable; the limb merely

requires to be laid upon a pillow in the position most comfortable to the patient. It is a common practice to apply ice immediately, with or without a previously applied rubber bandage, with a view, I suppose, to arresting the bleeding. That ice does at times to some degree relieve pain by rendering the part more or less numb I have no doubt, but that it helps to avert the bleeding there is, I fancy, no evidence, and it is not always harmless ; for example, in the case of a rather frail, anæmic subject in St. George's Hospital, the application of an ice-bag to a knee of this kind was followed by sloughing of the skin over the patella.

A few years ago I made some rather extensive observations of the relative effects of cold and heat in the treatment of certain conditions, amongst others acute knee distension, and it was clear that hot compresses were much preferred by a large majority of the patients, whilst the local effect appeared to be better. I therefore do not use cold applications in these cases, but employ the hyperæmic treatment or hot compresses, preferably of lead and opium lotion.

The pain due to mere tension is often extreme, leading to rapidity of pulse, nervous irritability, sleeplessness and a rise of temperature reaching at times as much as 103° F. Locally nothing is so efficacious in relieving this pain as gentle shampooing with a very light hand, by which I have seen

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patients restless and irritable from pain sent to sleep in a few minutes.

Failing this the usual anodynes must, of course, be employed. In some cases in which the pain proved uncontrollable I have given exit to blood and clot through a small incision by the side of the patella, washing out the joint with normal saline solution : such drastic measures are, however, rarely called for, although if all goes well the progress of the case is greatly expedited ; obviously they are only admissible when absolute asepsis can be assured.

As soon as the tension in the joint shows any sign of diminishing gentle bandage pressure and daily massage should be employed when obtainable, the patient being instructed to gently flex and extend the leg as much as can comfortably be done ; this is my practice, which is contrary to that of complete immobilisation used by many surgeons. My experience is that slight movement of the kind is conducive to absorption rather than the reverse, and that it goes far to remove the tendency to adhesions, which form so readily in these cases and give so much trouble subsequently. As soon as the joint can be handled without material pain, methodical massage, passive movement and resistance exercises are indicated, and all pressure about the joint by bandages should be discontinued as it tends to perpetuate muscle waste in the thigh. Should massage not be available, voluntary movements by the patient with

very gentle bandage support must be relied upon. The time which should be allowed to supervene between the injury and resumption of walking naturally varies in different cases. Speaking generally it is safe to allow careful walking when there is no longer any noticeable increase of local heat, although the fluid may not have disappeared.

If there is reason to suspect hæmophilia as a factor in the case massage and exercises are, of course, inadvisable, absolute rest until all fluid has disappeared being the essential indication.

The result following upon extravasation of blood into the knee-joint is generally—if the patient be treated with ordinary skill and is not the subject of some illness or constitutional condition which militates against it—that the blood is absorbed, a sound joint being looked for at any time from a fortnight to six weeks after the injury, according to the severity of the case and the circumstances in which it is treated.

Acute or chronic synovitis may, however, supervene, and suppuration occasionally occurs.

The remote effects are for practical purposes three : (1) stiffness of the joint from the formation of adhesions ; (2) the formation of loose bodies (formerly called loose cartilages) lying free in the joint, or of pedunculated masses attached to the synovial membrane, sometimes in great numbers, produced by organisation of fibrinous clot, and a second variety

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of attached bodies arising from hypertrophy of the synovial fringes or folds ; and (3) looseness of the joint generally, unless proper attention be paid to the condition of the muscles of the thigh in the early stage of the case.

Acute traumatic synovitis.—Distension of the knee-joint from acute inflammatory effusion is one of the most painful of affections, the incidence of the pain, which increases with the degree of distension, being mainly across the joint above and about the patella. This is increased by flexion beyond a point midway beyond extension and semi-flexion, and if reflex contraction of the flexors of the thigh is continuous, it is somewhat relieved by gentle extension of the leg upon the thigh. In the early stage the position in which the capacity of the joint is greatest is assumed, but very soon there is a tendency, in consequence of the contraction of the flexor muscles, to a gradual bending to a right angle. This renders a comfortable retaining splint desirable, to which the limb is lightly fixed in the position which is most comfortable to the patient. The relief of pain is usually the primary indication, and, apart from the use of narcotics or other drugs, this can only be done by diminishing the tension in the joint capsule. Very hot applications constantly changed are efficacious in the majority of cases, but in some nothing but the removal of fluid preferably by aspiration suffices, followed by gentle bandage pressure. The imme-

diate comfort afforded by this treatment is so great, and in many cases the shortening of the case is so marked, that when asepsis can be secured it is a treatment which may always be adopted with advantage. The attempt to relieve pain by blistering, or by the use of leeches, although still sometimes used, is unsurgical, and seldom effects the end in view. Moreover, leeches are by no means harmless: two of the worst cases of erysipelas I have seen in the lower limbs followed the application of leeches to the knee in acute synovial distension. Directly the tension begins to diminish spontaneously, or after the withdrawal of fluid, the patient may be allowed to very gently flex and extend the limb as much as can be done without pain, attempts at extension being the most important in consequence of the tendency to spontaneous contraction of the hamstring muscles. As soon as the capsule ceases to be tense and the local heat is only moderate, gentle massage and discriminating movements may be used, or failing the feasibility of obtaining sufficiently skilful massage voluntary movements upon the lines just mentioned may be advantageously encouraged, and it is upon the proper employment of movements, voluntary and resistant, that the completion of the cure itself will finally depend.

Results of acute traumatic synovitis.—As a rule complete recovery, that is to say, a return to normality in the joint, occurs if the case is intelligently

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treated, but limitation of movement may follow in degrees varying from a slight stiffness to complete ankylosis, the degree of the defect depending in some cases upon the insufficient perseverance in the use of exercises, and in others upon the inability of patients to bear the pain, which is sometimes considerable, caused by their use. It cannot be too strongly emphasised that, as a rule, the longer a joint which has been the subject of acute inflammation is immobilised, the greater is the pain produced in attempting to restore movement in it, whereas if a joint is kept gently moving, to ever so small a degree, the commencement of methodical movements is comparatively painless, excepting in a certain type of "nervous" patient, with whom they may be altogether impossible. The worst result which can follow in these cases is, of course, suppuration.

II. IN DISEASE.

The causes of acute effusion into the knee-joint are the same as those in other joints, but from mechanical peculiarity and circumstances of strain, the knee is more frequently than any other part either the primary seat of effusion, or later in the course of a case, may remain the last joint to be affected, and, indeed, may then be the only bar standing in the way of complete recovery. Cases in which the knee trouble is the predominant factor are alone concerned in the

present discussion. Acute effusion into the knee as a prominent symptom may occur at any time of life ; it is, for example, seen in infants a few weeks old as the result of septic infections, generally gonorrhœal, from the mother, and in the early years of childhood it may occur during influenza. I have seen acute distension of the knee-joint in children of four, five and seven years of age during influenza. These knee conditions in infancy and very early childhood are frequently overlooked by the mother or nurse, who ascribes the continual crying and fretfulness of the child to "wind in the stomach" or bad temper, and I have seen a case in which imperfect examination led to an opinion that rickets was the disturbing cause, when in reality a gonococcal infection was at the bottom of the case. There is little doubt that many a baby and young child who has been reckoned merely peevish and irritable has really been the subject of knee-joint trouble of the kind under consideration. In infancy the diagnosis is often difficult in consequence of the deceptive swelling occurring in rickets, scurvy, and epiphysitis, especially of the syphilitic type. Later in life, especially between adolescence and twenty-five years of age, the main conditions in which the knee seems, as a rule, to receive the brunt of the trouble are acute rheumatism, gonorrhœal arthritis, auto-intoxication from the intestinal tract, tuberculosis, pyæmia, and what is commonly called rheumatoid arthritis, but which is

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as a rule a septic infection, from auto-inoculation, and, of course, about and after middle age, "gout."

The way in which acute effusion into the knee may occur at the onset of a general septic infection is well illustrated by the following case :

CLINICAL EXAMPLE No. 1.—A man, aged twenty-two years, whilst returning home from business stopped to watch some drainage repairs in a London street, and was conscious as he did so of the inhalation of something very offensive. He felt unwell almost at once, and during the following night had a rigor ; about noon of the next day acute pain came on in the right knee, which rapidly became distended ; the temperature soon reached 102° F., and another rigor followed within twelve hours. The pain in the joint diminished, but the tension continued ; the temperature rose to 103° F. and the pulse to 120–130. Fearing pus in the joint it was emptied by means of the aspirator, the contents being a slightly cloudy synovial fluid, containing upon examination many leucocytes and bacteria of the nature of which there is unfortunately no note. With the relief of the tension, which was very great, the symptoms rapidly subsided, and after an excessively exhausting attack of diarrhœa, which lasted forty-eight hours, a tedious convalescence commenced.

The pain in acute effusion from disease varies greatly ; in acute rheumatism gout and gonorrhœal

arthritis it is most intense ; in pyæmia, on the other hand, it may be almost wanting. It is in fact, speaking generally, less in acute septic conditions, frequently, no doubt, because of the dulled perception due to septic intoxication. Apart from those cases in which pain is unnoticed in consequence of septic intoxication ; the septic joint of enteric fever, the pneumococcic joint, and certain cases of acute effusion in connection with auto-intoxication are good examples of the only moderately painful or sometimes almost painless type, the comparative or complete absence of pain being due to want of tension in any marked degree. The characteristic point, indeed, in the sudden effusion of pyæmia, especially when occurring after a long illness, is flaccidity of the joint, which wobbles like a half-filled water cushion. It is an important, and not in these days, perhaps, an altogether well-known clinical fact, that when, the temperature being high at the time of the occurrence of this type of effusion, the joint remains flaccid or soft, the tendency to disorganisation is greater than when there is great tension, which is best illustrated in enteric cases, in which a sudden luxation of a joint, most frequently the hip, may be the first thing to call attention to the existence of the condition.

The treatment, then, of acute knee-joint effusion in disease is frequently a mere incident, although it may be an important one, in the course of a general illness. The first indication generally is the relief

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of pain, which means the relief of tension. The methods applicable are those already mentioned in connection with traumatic effusion, the use of a splint being generally indicated, except in chronic pyæmic cases, in consequence of the tendency to hamstring contraction. I am quite sure in the case of the knee, although it may be different with more deeply-seated articulations, that unless the tension yields rapidly to the treatment of the disease upon which the knee trouble depends, the sooner the joint is emptied by the aspirator the better, not only on account of the immediate relief to pain, when it exists, which follows, but also because in doubtful cases it gives an opportunity for bacteriological examination, which may clear up the diagnosis and give a clue to the proper treatment of the general condition. The treatment of cases in which pus has not been present, progressing towards convalescence, should be upon the lines already indicated, the main thing to guard against being too long immobilisation. The treatment of joints containing pus will be considered immediately.

CHAPTER III

ACUTE SUPPURATION IN THE KNEE-JOINT

It is of primary importance to fully understand that suppuration, although naturally a serious event in a joint like the knee, is not necessarily associated with disorganisation of the articulation, and that as a rule there is every reason to anticipate that, with judicious treatment, a sound limb will result. I am led to make this observation because it seems to me that there is a tendency with present-day surgeons to take rather too gloomy a view of suppuration in joints, and that in these days extreme measures are perhaps at times too readily contemplated. This is probably, I suppose, accounted for by the fact that, as cases now so commonly progress without any check or drawback, when an untoward complication like suppuration in a joint occurs, especially after operation, its comparative rarity leads to less familiarity with its treatment than existed in the time immediately before the era of surgical cleanliness began, when

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the surgeon was mainly occupied in fighting conditions of the kind.

Acute suppuration after injury.—Suppuration in the knee-joint after injury, which includes, of course, post-operative suppuration, is, generally speaking, rare at the present time. When occurring it is usually caused by neglect or improper treatment in blood effusion or acute synovitis, or from the effect of constitutional conditions such as influenza, malaria, enteric fever, and other blood dyscrasias, the brunt of which falls upon the point of least resistance for the time being, and so leads, especially if any source or focus of septic infection exists, to suppuration of the joint contents, which in a healthy subject would be normally absorbed.

CLINICAL EXAMPLE No. 2.—A woman, aged twenty-six years, of an anæmic and spare type, fell down some stone steps, damaging the right knee, which immediately filled with fluid (blood). There was not much general bruising, and the case followed the ordinary course of an extravasation into the joint, excepting that the temperature from the time of her first coming under observation was higher than the local condition justified. The effusion was beginning to subside when, on the seventh day, a rigor occurred, followed by the usual febrile exacerbation; suppuration in the joint followed almost immediately, streptococci being found in the evacuated pus. It was subsequently ascertained that the patient was the

subject of a foul uterine and vaginal discharge containing similar micro-organisms. It cannot, I suppose, be doubted here that the vaginal discharge was responsible for the knee-joint infection.

CLINICAL EXAMPLE No. 3.—A man, aged thirty-eight years, received a heavy blow on the inner side of the right knee, which, although painful at the moment and remaining somewhat stiff, called for little remark until four or five days later, when swelling set in rather rapidly after a short walk. Acute synovitis with great tension supervened. Under treatment all seemed going well, when on the tenth day, after a feeling of coldness but no rigor, the temperature rapidly rose to 103° F., the joint became increasingly tense and acutely painful; suppuration followed, streptococci being found in the pus. Subsequent investigation revealed the existence of an ischio-rectal abscess of old standing, which generally discharged freely but closed temporarily from time to time, when feelings of coldness and a sense of illness continued until the abscess opened up again.

Of the general constitutional conditions which tend to suppuration in damaged joints influenza is probably the greatest offender, excepting, of course, conditions of pyæmia or septicæmia. During one of the earlier epidemics of influenza I had under my care at the same time no less than four suppurating knee-joints occurring in patients who, after accidents, developed influenza; two of these were published in

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the 'Lancet.' It is interesting to know that recently a micro-organism peculiar to influenza has been identified in the pus of joints suppurating during the progress of that disease.

In the absence of rigors the diagnosis of suppuration is not always easy, but aggravated pain of a stabbing or throbbing kind, with rapidly increasing tension in a joint previously comfortable and shrinking, general rise of temperature with a flushed face, quick pulse and dirty tongue are suggestive indications. Redness of the skin should only be expected in greatly neglected cases, and is rarely seen under ordinary circumstances excepting as a coincidence. The most deceptive redness is that which is sometimes caused by an attack of gouty inflammation over an already distended joint. It is a good and prudent rule not to proceed with heroic measures in apparent suppuration until the diagnosis has been established by exploratory aspiration, care being taken to ensure asepsis and to avoid entering the needle through any inflamed skin area, lest in the event of the joint not containing pus it may become infected through the micro-organisms carried in by the needle from the inflamed region. This preliminary puncture further performs the double function of allowing of a bacteriological examination of the fluid withdrawn, and if the joint be merely distended by synovial fluid, of relieving tension and so contributing to the cure of the case.

Acute suppuration secondary to, or consequent upon, general constitutional states.—For clinical purposes this may be divided into two classes: one in which the joint complication is multiple, the knee being merely a single factor in a general suppurative development, and the other in which acute arthritis of the synovial type undergoes suppurative changes in the course of the disease, the knee being generally in such circumstances the joint involved. The first type is best illustrated by diseases like pyæmia or multiple pneumococcic arthritis, the second by suppuration in synovitis occurring during influenza, in certain cases of acute rheumatism (so-called), and rarely in gonorrhœa of the mixed infection type. In all cases, of course, the general disease is primarily the important matter, but as the disease progresses the joint complication may become predominant, and the treatment for the time being may resolve itself into the management of the local condition, the treatment of the general state being continued at the same time or not as the circumstances of the case dictate. For example, it is not altogether rare to find the state of a single knee-joint remain a grave concern in a case of “acute rheumatism” long after the general symptoms have disappeared.

So far as the physical signs go the suppurating knee occurring in the course of a general disease is of two varieties—that which is characterised by

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acute pain and great tension, and that which is only moderately or not at all painful, and either only moderately tense or even flaccid. The former type is found in cases of acute synovitis such as is met with in acute rheumatism, influenza, and sometimes in acute tuberculous disease in which suppuration occurs, the latter type being peculiar to cases in which the pus formation is immediate, such as pyæmia, pneumococcic arthritis, and rarely enteric fever. One of the most important points in connection with suppurative arthritis is a full realisation that tension is not always present, especially as the onset of the pyæmic knee and others of that type frequently coincides with a fall of temperature, which may easily prove dangerously deceptive. The tense suppurating knee, on the other hand, is always associated with a high and rising temperature. The diagnosis of these cases does not materially differ from that of suppuration after injury, with the exception of those to which reference has been made, in which, the pus formation being immediate, there is neither tension, great pain, nor a rising temperature. It is, however, necessary to avoid being misled by appearances of redness on the surface of the skin, which occur frequently in acute synovitis in septic cases quite apart from suppuration, and it is well to be alive to the occurrence, as a very deceptive symptom, of localised pseudo-œdema, which is apt to show itself around joints, especially

in rheumatism. It is obvious that œdema-like swellings with redness might easily lead to a suspicion of suppuration in a joint already distended by synovitis, but the peculiarity of this form of local œdema, viz. its transient character, disappearing and reappearing as it frequently does, and the absence of pitting on pressure is sufficient to distinguish it from true œdema, such as might be associated with acute suppurative arthritis. In any case when a suspicion of suppuration exists the exploratory aspirator will clear up the question and may with ordinary care be safely employed.

Treatment of acute suppuration.—The diagnosis having been established the immediate treatment of suppuration of this kind may, generally speaking, be summed up in the words, free lateral incisions and drainage, the use of tubes of large calibre being, in my experience, more satisfactory than drains of gauze or other kindred material. There are, however, cases in which drastic treatment of this kind is not needful. If, for instance, the pus drawn off in the course of the exploratory aspiration be sterile, I have not always found it necessary to lay open the joint, a second aspiration being generally all that is necessary for the cure, in spite of the fact, which must be remembered, that the absence of micro-organisms in the fluid withdrawn is no positive evidence of sterility of the joint itself, since the habitat of these organisms may primarily be the

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synovial membrane and not the fluid in the joint, although they are frequently found in it. In the semi-flaccid pyæmic joint free incision is rarely necessary, aspiration being usually sufficient; indeed, as a matter of fact, the effusion in these cases may disappear spontaneously with considerable rapidity; unless, therefore, the general condition of the patient points to the necessity of urgent interference, some slight delay before resorting to it may sometimes be advantageous.

In cases requiring free incision and drainage the most difficult matter is the management subsequently. The common practice is to secure as complete immobilisation as possible, and to freely wash out the joint as often as feasible with some antiseptic solution. Personally, I place the limb lightly on a splint, the bandages being only loosely applied, so that a considerable amount of movement of the joint is possible, and I encourage the patient from the first to flex and extend the limb within the bandages as much as can be done without pain, and it is a singular fact that these movements are more frequently a source of comfort than of pain. With a view to allowing greater scope for movement I leave off splints as soon as all tendency to "starting" during sleep has ceased. The quickest results obtained in suppuration of this kind have been by this plan, in consequence of the way in which the pus is squeezed out of the joint during the move-

ments and the diminution in the tendency to the formation of adhesions. This movement is encouraged from the beginning to prevent as much as possible stiffness from adhesions. The more experience I gain the more I feel sure that the complete immobilisation commonly used in cases of the kind is a mistake excepting under special circumstances, as it is frequently unnecessary, and always tends to production of what is most feared in these cases, viz. ankylosis.*

Should disorganisation of the joint occur, *i. e.* disintegration of the ligaments with destruction of the articular cartilage, the obvious indication is to obtain a firm ankylosis in a slightly bent or straight position. With reference to attempts to obtain partial mobility, it must never be forgotten that a firmly ankylosed joint in a position suitable to the circumstances in which it has to be used is, speaking generally, far more convenient than a partially movable one if it be either weak or painful. It is of course essential that in every case of suppuration a bacteriological examination of the discharge should if possible be made in order to determine the nature of the micro-organism involved, a culture being subsequently made with the object of procuring a suitable vaccine, should the later stages of the case render its use desirable.

* For details of the use of the treatment of these cases by induced hyperæmia see Chapter XVI.

CHAPTER IV

PAINLESS EFFUSION INTO THE KNEE-JOINT

OCCURRING MAINLY IN WOMEN AND YOUNG GIRLS,
AND IN BOYS AT THE ADOLESCENT PERIOD.

SWELLING of the knee-joint is not uncommonly discovered accidentally in girls between the ages of ten and fourteen and in women at any time of life; occasionally a similar discovery is made in boys during the period of adolescence. The swelling is due to passive effusion into the joint; it rarely occurs in any other joint than the knee. The ankle is sometimes found to contain fluid, although not in sufficient quantity to attract attention without careful examination.

The joints of the opposite sides are usually involved at the same time, but the effusion is, as a rule, much more marked on one side than on the other, that on the right side being generally the greater. There is rarely any pain unless some injury has been received, and beyond a feeling sometimes of weakness

there is nothing to attract attention to the matter ; hence, a considerable percentage of those who suffer from the complaint are unaware of its existence unless attention is called to it accidentally. It is, as a rule, limited to girls and women, and is always associated with menstrual irregularity or uterine trouble. It occurs mainly at two periods of life, viz. at the time of puberty, when the catamenial affairs are establishing themselves, and at the climacteric time when menstruation begins to cease. It may, however, occur at any intermediate period if there is menorrhagia, hæmorrhage from the uterus from other causes, or great irregularity and difficulty in connection with menstrual matters.

My attention was first attracted to this affection some years ago, when I met with several cases of painless and unnoticed effusion into the knee-joints of girls of twelve and thirteen years of age ; and I found upon examining a number of girls who were attending as out-patients at St. George's Hospital that certain of them had painless swellings of the knees of which they and their parents were unaware. In all these cases there was delayed onset of menstruation. Upon inquiry it was found that in some of them, although neither the children nor their parents knew of anything being wrong, the children tired easily, and in some cases were prone to fall down or "double up" without any obvious cause.

The character of the joint is peculiar ; although

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containing a considerable amount of fluid it is never tense excepting after superadded injury. The fluid, if the patient is standing, sinks to the lower part of the joint-cavity, and sometimes leads to a pouch-like overhanging of the synovial membrane at its lower anterior aspect. In the older subjects the aspects of the condition are similar, the main points being the absence of tension and heat and the freedom from pain. The patients are usually anæmic but not invariably so. It may be well here to recall to mind the fact that a small quantity of fluid in the knee-joint which, when the joint is flexed or if the patient is lying down, can only be detected by very expert observers, becomes quite obvious on placing the patient in the standing position.

As already mentioned, the common cause of the discovery of the condition is an injury, generally very slight, such as a twist or fall; the occurrence of an injury and the existence of effusion naturally lead to a diagnosis of traumatic synovitis, which, being apparently of a very chronic nature and occurring in subjects of a delicate type, is sometimes mistaken for tuberculous disease—an error of some importance. Mistakes in diagnosis can usually be avoided by noticing the character of the swelling, the existence of effusion on both sides (that on the uninjured side being painless and without heat), and the coincidence of marked menstrual or uterine trouble.

CLINICAL EXAMPLE No. 4.—A girl, aged fourteen years, was brought to me who, a few months previously, whilst walking across the room, had knocked her knee against a chair. She complained of nothing at the time of the injury, but on the following day, as she seemed to walk a little lame, her mother noticed that the right knee was held rather stiffly. Upon examination she found it swollen, but not tender. Professional advice was sought, and effusion into the knee was diagnosed. The usual treatment by rest was adopted for some weeks without any material benefit. Further advice was, therefore, taken, a somewhat grave opinion being expressed in respect to the possibility of the case being tuberculous, and I was assured that this opinion was given without a previous examination of the opposite knee. Whether this was really so or not I cannot, of course, say, but at all events further treatment on the lines previously adopted produced no good result. Later on I saw the patient, and upon investigation found that both knees contained a good deal of fluid; neither joint was tense; there was no pain or tenderness; the local temperature on the side which had been injured was, however, certainly rather more than on the other. The girl was anæmic and of a delicate aspect. She had not yet menstruated, but certain pains and symptoms of irritability clearly indicated that menstrual developments were tending to come about. Under the circumstances, judging

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by my previous experience of similar cases, I ventured to predict that the trouble would subside upon the establishment of the catamenial function, and advised the discontinuance of rest and splinting, which had made the injured joint already somewhat stiff, substituting exercise and massage, with as much fresh air as possible. The menstrual affairs, although much delayed, occurred ultimately with great profusion. From the moment of the onset of the catamenial discharge improvement commenced, and at the end of a fortnight after the second catamenial period the knees rapidly became normal and remained so subsequently.

CLINICAL EXAMPLE No. 5. — A well-developed woman, aged twenty-four years, met with a slight injury to one of her knees. She took little notice of the injury, but on the following day, upon getting up in the morning, she noticed some stiffness in the injured knee, and upon examination found it swollen. For a fortnight, as the discomfort was but slight, no further attention was paid to the matter, but then, as the swelling persisted, a surgeon was consulted. He took a rather serious view of the condition, and urged immediate splinting of the part with rest in bed for at least a month. As the patient was one of those people who live in the open air, and was much addicted to hunting and golf, this recommendation was regarded with dismay, especially as beyond the swelling little or no discomfort was pre-

sent. She was then brought to me for an alternative opinion. Upon examination the left knee was considerably swollen from effusion ; it was not tense. In the erect position the synovial membrane tended to drop forwards and to overhang the part below the joint. Beyond a feeling of slight stiffness, which was not enough to produce anything like a noticeable limp, the symptoms were otherwise negative. The opposite knee also contained fluid, which, although not obvious when the patient was sitting in a chair, became at once manifest in the standing position. This knee had received no injury nor was the patient aware of the existence of the fluid ; indeed, she was certain that this as well as the injured knee was free from fluid before the injury—clearly an error on her part. Upon inquiry it appeared that the menstrual affairs had always been irregular and very painful, and at the time of her coming to see me the catamenia had been absent for two months, although at the last normal date she had felt ill and irritable and had suffered from distressing bearing-down pains. Judging from the general aspect of the case I came to the conclusion that it was one of the kind now under observation. I therefore felt compelled, in spite of the opinion already given, to deprecate the use of splints and rest in bed, the latter of which seemed to me likely to be extremely disadvantageous to a patient of such habits and disposition as this one possessed. Massage was, therefore, recommended,

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with moderate exercise, in the open air as much as possible, and the resort to some obstetric authority with a view to the rectification of the menstrual defects. Two opinions so exactly opposite naturally necessitated the reference of the case to a third surgeon, a man of much discretion, who, adopting very wisely a strictly judicial attitude, declined to commit himself unreservedly to either view, but went so far as to say that confinement to bed in a temperament like that of the patient was to be avoided if possible. The treatment on the lines of my opinion was, therefore, adopted, and with the onset of regular menstruation, which happily followed a little later, the knee trouble entirely disappeared, although it recurred temporarily before the two succeeding menstruations.

CLINICAL EXAMPLE No. 6.—This patient was in St. George's Hospital under the care of Dr. W. R. Dakin. She was a married woman, aged twenty-six years, who was admitted on July 8th, 1898. Since her first confinement, six years previously, she had suffered at menstrual times from great abdominal pain. The catamenia had been extremely profuse and exhausting. For two or three years she had been continually ailing, and latterly any attempt at getting about or doing her ordinary work caused intense malaise. For eighteen months the knees had been "stiff and hot" before the menstrual times, but she had noticed no swelling either of the knees or of the

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legs. On admission the patient was found to be anæmic, and she seemed ill. There was tenderness over the right ovary on deep pressure. The right knee, she said, was stiff and uncomfortable. There was considerable effusion in the joint, which was, however, flaccid—not tense; there was neither tenderness nor any increase of local heat. The limb below was perfectly normal. The opposite knee also contained a little fluid. On July 16th the effusion in both knees had subsided a little, on the 18th it had increased considerably, and on the 19th profuse menorrhagia with large clots and much pain occurred. Considerable hæmorrhage continued, being profuse until the 27th, when it diminished somewhat. The effusion in the knees during this time rose and fell from time to time; sometimes it was slight, sometimes great, but at no time did the joints on either side become tense, nor was any other joint than the knee involved. On August 8th the uterus was curetted; on the 10th all hæmorrhage ceased, and by the 19th both knees were apparently normal. The patient reported herself for examination on October 1st, and she was then perfectly well; the knees had given no trouble of any kind, and upon examination they were found to be sound in all respects. A more conclusive case than this it would be difficult to find.

CLINICAL EXAMPLE No. 7. — A married woman, passing through the climacteric period, wrenched

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her right knee in getting out of a cab. The injury was very slight, and she thought nothing of it until the following day, when, on rising from her bed in the morning, she found the knee a little stiff, and upon inspection saw that it was considerably swollen. She therefore sought advice. On examination the knee was found to be swollen, and it contained a considerable amount of fluid; the joint was not in any sense distended—on the contrary, the capsule was rather flaccid; the fluid in the standing position gravitated to the lower and anterior aspect of the joint, causing some slight “sagging” of the kind which I have previously referred to. The other knee contained almost as much fluid, and presented the same characteristics as the injured joint. Of the existence of anything abnormal on the uninjured side the patient was entirely ignorant until it was pointed out to her. On inquiry, she then stated that the “change of life” had commenced about six months previously, and at times very free loss of blood had happened; after these considerable losses she now remembered that she generally felt very tired upon much exertion, and that on two occasions she had felt a tendency when walking for her knees to “give way.” Of this she thought nothing, as she attributed it merely to weakness from pain and loss of blood. She was kept under observation, and during the whole of the climacteric period, which extended over about eighteen months, the knees con-

tained fluid, sometimes a little and sometimes quite a large quantity. The increase in quantity usually, but not always, followed increased pain or extra blood-flow. The fluid could be almost entirely removed at any time by a week's massage, but it immediately recurred upon the cessation of the treatment. At the end of the climacteric period both joints became normal, and they have never shown any indication of recurrence of the effusion since. The noteworthy points in this case, as in the others, are: (1) The escape of the condition from observation until attention had been attracted to it by injury; (2) the almost rhythmical rise and fall in the quantity of the effusion; (3) the absence of tension in the joint, which was replaced by the peculiar flaccidity; and (4) the spontaneous return to the normal state upon the subsidence of the uterine irregularities.

CLINICAL EXAMPLE No. 8.—The patient was a girl, aged fourteen years, who was suffering from the troubles which sometimes arise at that period of life from delayed or painful menstruation. After a slight injury the right knee was found to be swollen considerably. Prolonged splinting with complete rest failed to affect the condition in any noticeable way; the child, on the other hand, began to fail in health from confinement to the house and want of exercise. It was then found that the opposite knee contained fluid in considerable quantity, and it was thought

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that this effusion in the hitherto sound knee was sudden. The onset of the menstrual period was imminent; the knee was rather hot to the touch, and the temperature was 101° F.; at times the girl felt "shivery" but had no actual rigor. The question therefore arose as to the possibility of the apparently sudden effusion into the knee being a secondary pyæmic condition or something of that kind. There appeared to be no doubt, however, that the case was one of the sort under discussion, and that the febrile and general disturbance was merely due to catamenial causes. The case was treated on this supposition; splints were omitted, massage and exercise in the open air as much as possible being substituted. Immediate improvement followed, and with the gradual spontaneous rectification in the menstrual irregularities, which ensued in the course of eighteen months, the knee trouble entirely disappeared. It is obvious in this case that the knowledge of the occurrence of these conditions was of vital importance for the proper treatment of the patient.

During the past few years I have seen about fifty typical examples in females, in all of which the trouble had been attributed to other causes. In three cases fluid was withdrawn from the knee by means of an exploring needle; in two of these the fluid was ordinary synovia, in the other it contained a considerable amount of blood. Whether this was an accidental

occurrence or whether it had any pathological bearing upon the mechanism of the effusion I cannot say. In very few cases have I seen the effusion occur in any other joints than the knees ; in the exceptions the effusion occurred into the ankle in very rheumatic subjects. The causes assigned for the condition were, in order of frequency, injury, tubercle, rheumatism and "blood-poisoning." In no case did recovery occur whilst the uterine or catamenial irregularities continued ; in every case, on the other hand, so far as my memory serves me, correction of these irregularities, whether spontaneously or by treatment, was followed by complete disappearance of the tendency to effusion into the knees.

With regard to boys it is difficult sometimes to understand the reason of such an effusion. Although not altogether a common condition, its occurrence is, in my experience, of sufficient frequency to be of clinical importance.

The subjects affected are generally of a nervous, irritable and anæmic type, in fact, very much the same type as that met with in females similarly affected. And there appears to be no doubt that the condition is due in some way or another to the disturbance in the genital system which takes place at this period ; but in boys, unlike girls, the effusion invariably passes off at the end of adolescence, unless a habit of self-abuse has been acquired or unless the subject becomes anæmic or

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debilitated from some other cause. The proper appreciation of these cases, and the manner in which they should be treated, are obviously serious matters. From a practical standpoint the treatment required is very little ; the important matter is rather to know what to avoid. On no account should these patients be laid up with a view to immobilising the limbs. That is the worst thing that can be done, for the reason that rest leads to flaccidity of the muscles of the thigh and other parts, and directly tends to that looseness of the knee-joint which is of so much importance.

CLINICAL EXAMPLE No. 9.—A boy, aged fourteen years, of a highly nervous disposition, anæmic, and apparently wanting in the power of mental concentration, was found accidentally to have a painless swelling of the right knee of which he was entirely unaware. Having regard to his age and apparent delicacy tuberculosis was suspected. Upon examination the boy was of the type mentioned. There was considerable effusion in the right knee, and the left knee—a point which had not been previously noticed—contained fluid, but less in quantity than the right ; there was no appreciable increase of local heat on either side. The aspect of the boy led to an investigation of his genital apparatus, which revealed a very long adherent prepuce, obviously a source of irritation, and probably responsible for unwholesome practices which accounted for the general

constitutional instability. Circumcision and removal of adhesions were followed by a rapid improvement in the boy's condition. With the help of massage and an active open-air life the knees became normal in less than six weeks, and at the end of a year from the time of the operation the boy was robust and doing well in every way. It is not difficult to realise the immensity of the disaster if, in a case like this, the condition of the knee were to be mistaken for tubercle and treated accordingly.

Diagnosis.—When called upon to examine a case of a woman or girl suffering from painless effusion into the knee, especially if she be at the period of the onset of the catamenial flow—*i. e.* from the ages of eleven to fourteen years—or at the climacteric, inquiry should always be made into the state of the uterine functions, and the ordinary surgical routine of examining both knees should never be omitted, although the patient may ascribe the effusion to a distinct injury of only one of them. If there be the functional irregularities to which I have referred fluid will, as a rule, be found in both knees, generally in excess on the right side, and although the patient may be convinced that the condition is due to recent injury it may be concluded for purposes of treatment that the injury is only an incident which has called attention to the effusion, and that it is not primarily responsible for it—in other words, that the case is one of the kind which

we are considering. In the absence of catamenial irregularity or uterine disorder some different reason must, on the other hand, be sought to account for the local condition.

Prognosis.—The prognosis in these cases, if treated on the lines indicated, is always good, provided that the primary cause of the effusion can be cured, in which case recovery invariably follows unless the condition has persisted so long as to produce permanent changes in the joint. If the primary condition proves intractable the effusion will occur continuously at intervals. In cases where the effusion is continuous or is constantly recurring an increasing weakness of the knees supervenes, and in the later stages, when the health becomes broken down by frequent loss of blood or great pain, œdema of the legs may follow, but in this there is no specific meaning, since it is merely the result of continual exhausting illness.

Treatment.—In the matter of treatment a correct interpretation of these cases is of vital importance, especially in young subjects, in whom the chronicity of the condition and the delicate aspect of the patient may suggest tuberculous disease if the attention be too much concentrated on one knee only, and may lead to a treatment by splints and complete rest, which, in the catamenial and uterine cases, is the worst for adoption and should be rigorously avoided. The primary treatment should be

directed to the correction of the faulty functions, whilst moderate exercise and massage for the knees, combined with the healthiest of outdoor lives, are collateral indications; beyond everything, splints should be avoided, and on no account should the patient be allowed to lead an invalid's life unless the loss of blood, pain or other conditions render this absolutely unavoidable. In the absence of acute symptoms arising from injury the condition of the knees need lead to no restriction in the exercise of an ordinary person.

CHAPTER V

PAINLESS EFFUSION INTO THE KNEE-JOINT

FROM CAUSES OTHER THAN THOSE MENTIONED IN
CHAPTER IV.

APART from the special class of case considered in the previous chapter, there is no doubt that painless effusion, of which the patient is quite unaware, occurs more commonly in the knee-joint or joints than is generally supposed ; and its discovery, frequently brought about by some slight injury, sometimes leads to errors in diagnosis, with unnecessary exaggeration of the importance of the condition by those who do not understand its exact significance.

The reason of the knee being more liable than other articulations to effusion probably lies in the fact that the leverage on it is greater than in other joints, that it is at a certain mechanical disadvantage, especially in long-legged people, and that it is more vulnerable, inasmuch as its synovial apparatus is less protected by soft parts than that of any other major articulation of the body.

For clinical purposes painless effusion into the knee-joint may be divided into three classes :

(1) Effusion, with or without local heat, occurring at any time of life ; (2) effusion occurring in the young about the period of adolescence ; and (3) effusion occurring in adults and old people. The tension of the capsule of the knee-joint depends, for the most part, upon the tonicity of the muscles of the thigh and buttock ; in other words, well developed muscles there generally mean a high degree of tension and tone in the capsule of the knee. On the other hand, weak or flabby muscles in the same parts are always associated with more or less flaccidity of the capsule of the joint, and, of course, also of the synovial membrane. Further, as has been already pointed out, the rigidity of the knee in various subjects differs to a great degree. One individual may have a knee so well set up as to prevent, in the extended condition of the limb, any lateral movement perceptible under ordinary circumstances. In another, the position of the limb being the same, there may be such an amount of lateral mobility in the knee as to justify the term “wobbling” being applied to it. This looseness of the knee-joint may be important, or it may not, and it consists of two kinds ; in the anatomical variety the looseness of the joint is merely a condition natural to the individual (such individuals being frequently called “double-jointed”) and not always confined to the

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knee-joint, although it may be more marked in that articulation than in any other. In the pathological variety it is the outcome of some defect or disease in connection with the joint itself or the muscles which support it. It is necessary for clinical purposes to be able to determine whether the looseness of the joint is of the anatomical or of the pathological type, because in connection with effusions into the knee it will be found that in the anatomical form of loose joint effusions are frequently happening, and are in a general way of little real consequence. On the other hand, effusions occurring in any joint which has become loose from pathological causes may be of very great importance. The anatomical looseness can, as a rule, be distinguished from the pathological by the fact that it is bilateral, the two joints being affected equally, or nearly so. In the pathological kind it is usually found that one joint is loose, the other being in a more or less natural condition of tone and strength. The due appreciation of the importance of the wobbling knee is of great clinical moment, because the gravity of effusion of the painless kind, or of any other kind for the matter of that, is in an inverse ratio to the amount of the laxity of the articulation; the looser the joint anatomically, the more liable it will be to passive effusion, and the less important will the effusion be.

It is a fact of some importance and one which seems to be less commonly known than would be expected,

that in the majority of young subjects whilst growing, especially if they be of the long-legged, anæmic type, it will be found that after any great amount of exercise some effusion into the knees takes place, unless the joints happen to be singularly well set up and strong. In most cases in which the knee is loose some effusion of fluid commonly occurs after excessive exercise—a very important point to bear in mind, in consequence of the tendency to refer accumulations of fluid after, for an example, a very energetic game of football, to injury, with the result that treatment of a totally wrong kind may be resorted to. Effusion of this kind, as a rule, disappears spontaneously within twenty-four hours of the cessation of the exercise which has led to its production. With regard to the detection of fluid in the knee-joint, especially of this kind, the following points, already referred to, must be borne in mind. First of all, it is quite impossible to be sure whether there is or is not fluid in the knee-joint unless the patient is examined in a standing position. There may be, especially in a wobbling knee, a considerable quantity of fluid which will be imperceptible to the ordinary methods of examination if the patient be in the horizontal position. On the assumption of the erect position the fluid sags down towards the anterior and front part of the joint in the neighbourhood of the ligamentum patellæ, and becomes readily manifest. But this examination alone is not

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sufficient to prove whether fluid exists or not, because in certain conditions, especially in cases of tubercle and in some cases of long-continued chronic or sub-acute inflammation of a non-tuberculous kind, there will be found on either side of the ligamentum patellæ and behind it a certain amount of thickening, which, in the erect position of the patient, is of exactly the same shape and appearance as that produced by the sagging down of fluid from the inside of the joint. It is therefore necessary, if such an appearance be seen in a knee-joint when the patient is in the erect position, to examine the part when the limb is horizontal, for the obvious reason that if the swelling is due to fluid it will disappear in that position, whilst, on the other hand, if it is due to chronic thickening it will remain unchanged.

Let us now pass on to the consideration of the clinical aspects of this condition. The chronic effusion of the painless kind, which is discovered accidentally in the manner which has been previously mentioned, is generally unassociated with any local increase in the temperature of the part, and it may then, as a local manifestation, be considered, in the absence of any marked constitutional condition, to be of little importance. On the other hand, if associated with increased local heat, which will be very slight—because if the increased heat were great there would certainly be pain, and that, of course, would put the case outside the type of those which are at present

under consideration—the condition assumes much greater importance, especially in relation to tubercle. The question of tubercle in passive effusions into the joints—we are speaking now of the knee—is a very important one, because it cannot be doubted that there is an inclination to consider tubercle as a cause of these chronic effusions much too frequently. It is often regarded as being a “fault on the right side” to incline to the diagnosis of tubercle in cases of this type, because it is said that even if the condition be not tubercle, the treatment which is adopted on the assumption that it is will, if not necessary, at all events do no harm. But that is by no means sure. The treatment of these chronic joints by the long-continued rest which is usually applied in the treatment of tubercle, is distinctly harmful in the event of the disease being of a non-tuberculous type, because, apart from the liability to bring about an unnecessary ankylosis, if these chronic conditions which are not tuberculous be treated as if they were, there is reason for believing that an impetus may be given to the onset of tuberculous change. The treatment of chronic effusion without heat should invariably be massage with exercise rather than rest and confinement in splints.

Although painless effusion in cases of loose knee may be, as I have said, in itself of small account, its constant repetition becomes a matter of importance for three principal reasons: (1) The tendency to

crippling from progressive weakening of the limb ; (2) the marked liability to acute developments after comparatively slight injuries ; and (3), perhaps the most important of all, the frequency with which internal derangement of the knee-joint occurs in cases of this type.

It is, therefore, obviously essential that laxness of the joint, when present in any degree, and especially when associated with recurrent effusion, should somehow be corrected. The best and most scientific method of effecting this in the majority of cases is by means of skilful massage and exercises ; but should these fail, or should circumstances make their employment impracticable, nothing remains but the use of an instrumental support, which, whilst strong and light, will allow of the normal range of movement in the joint without restriction (Fig. 4). The manufacture of this requires not only a highly skilled mechanician, but also one who has some adequate knowledge of the functions of the joint concerned.

The causes of painless effusion of the kind under consideration are local, remote, or constitutional.

With regard to the local causes I have already mentioned the subject of the "wobbling knee," and have pointed out how it may tend to the occurrence of effusion in people who are perfectly healthy. I have also shown that it is a harmful thing to attribute to doubtful injury the effusion which sometimes occurs in joints of this kind as a result merely

of great exertion. On the other hand, it is equally harmful to ignore altogether the effects of injury of

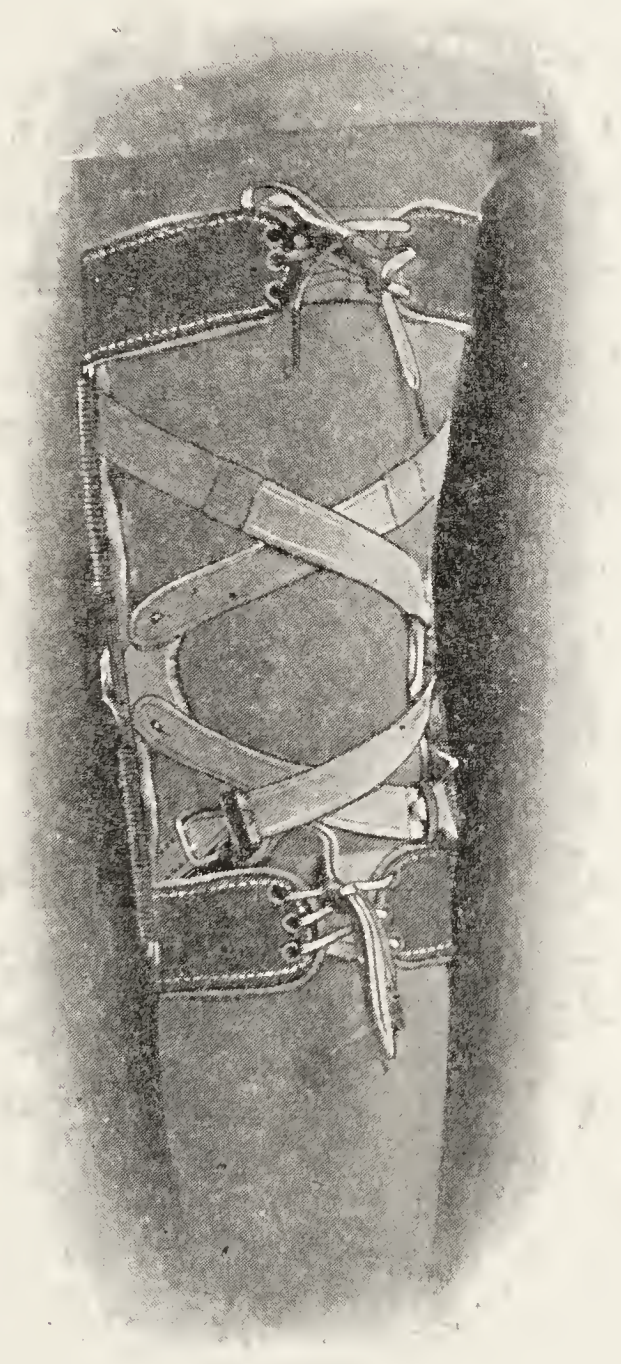


FIG. 4.—Instrument made by Mr. Ernst for the prevention of lateral movement and abnormal rotation in loose knees. It is the only instrument which I have found really effective in preventing displacement of the semi-lunar cartilage. The instrument varies in length according to the amount of mobility which has to be corrected; in extreme cases it may require to be extended to the boot. The ordinary movements of the knee are not interfered with.

a joint containing fluid in consequence of defective

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tonicity. The difference between the effusion of no importance in a knee of this type and the effusion which may be grave depends mainly upon the existence of a local increase of heat. Should there be no increase of heat the effusion may be lightly regarded. On the other hand, should there be markedly abnormal heat, until its disappearance the case should be watched assiduously.

So far as the constitutional or remote causes are concerned, uterine disorders, as already pointed out, account for a considerable percentage of these cases, and a cure of the articular effusion can only be brought about by the rectification or spontaneous disappearance of the uterine disorder. In one case which came under my observation a passive effusion of this kind, which had been pursuing the ordinary painless course for a long time, suppurated, apparently in consequence of the septic condition of the uterine cavity. So far as the treatment is concerned enough has been said. Massage to prevent loss of tone in the joint is indicated, and the question of the necessity for general rest must be determined upon ordinary lines. These cases, like others of which I have spoken, are too frequently thought to be gout, and a treatment adopted which, under the circumstances, is likely to be harmful and sometimes entails great waste of money in uselessly seeking relief at foreign or other "water-cure" places.

The acute septic infection of joints associated with

some forms of intestinal trouble we are now becoming fully familiar with ; but, so far as I know, no mention has been made of painless effusion into the knee-joint in connection with certain conditions of what seems to be merely chronic indigestion. These cases are more commonly, I think, attributed to gout than any other type of joint affection. But at all events, whether they are technically gout or not, they do not respond to the ordinary treatment of gout ; and they certainly do not improve nor, at all events, recover completely, so long as the intestinal condition remains untreated and uncured. It is fair to assume that such effusions are the result of chronic infection (septic) from the intestinal tract. It is, therefore, of particular importance, supposing we are faced with an effusion of this kind in both knee-joints—the condition is generally bilateral, although it may not always be so—to ascertain whether symptoms of gastro-intestinal irritation are present. In such cases it will usually be found that little or no progress will be made towards recovery from the knee trouble until the patient has been subjected to a thorough course of intestinal antiseptic treatment.

Painless effusion in anæmia is not uncommon, and is only worthy of special mention on the following grounds : (1) Increased local heat is generally present to a slight degree, and (2) the resulting laxity of the joint is liable to be relatively greater than in any other type of the affection. The former

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of these is responsible, I fancy, for the tendency to consider such cases tuberculous, especially when the effusion is unilateral, as is sometimes the case; the latter is important as indicating the line of local treatment to be adopted—namely, measures to preserve as fully as possible the muscular strength of the limb.

A not uncommon constitutional cause of painless effusion into the knee-joint, at all events in hospital patients between the age of ten and twenty years, is congenital syphilis. The diagnosis should present no great difficulty as corroborative symptoms are generally obvious. Effusion, of course, occurs in acquired syphilis, but it is rarely altogether painless.

The rapid painless enlargement met with in Charcot's disease (Plate II) must not be forgotten, and in connection with this condition it is of some interest to remember that the mere absence, however complete, of the patellar reflex is not necessarily evidence of grave nervous disease, since the condition of the parts about the joint in chronic changes of different kinds may make it impossible to elicit the sign although it may be present; moreover, the knee-jerks are occasionally wanting in perfectly healthy people.

Painless purulent effusion into the knee.—Very extraordinary painless effusions are sometimes met with.

CLINICAL EXAMPLE No. 10.—One of the most remarkable cases which I have seen was that of a

PLATE II.



A typical "Charcot's knee."

medical man of middle age, who, having been previously perfectly well, discovered that one of his knees was swollen. He had been working hard at the time, and he took but little notice of the trouble, continuing to conduct his affairs as usual. When seen the left knee was distended with fluid; it was quite painless, and was without heat. At first sight, after the history which had been given, I thought the case was in all probability one of Charcot's disease, as there were certain peculiarities suggestive of it; but I could not corroborate this diagnosis upon further investigation. It is true that I could get no knee-jerk on the side on which the effusion was, but that was evidently because the effusion was so extensive, and the parts so tense. He was treated for a time by massage, but without any effect; in fact, I exhausted the whole of the ordinary resources for a case of the kind, and still no good followed. It was then determined to aspirate the joint, with a view to subsequently applying pressure, and other means of treatment. To my surprise, on emptying the joint with the aspirator the fluid proved to be pus, slightly coloured with blood. It must be allowed that this was a remarkable case, because the man was in perfect health in every way except for the condition of his knee; and this, greatly swollen as it was, caused nothing but a feeling of tiredness. Upon having the pus examined in the usual way it was reported to be absolutely sterile. What the expla-

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nation of such a condition is I do not know. My main reason for mentioning the case is that it points a moral in the matter of treatment. According to all surgical tenets I ought to have laid the joint freely open, washed it out, and drained it. It was a joint which was full of pus; but having had experience in former times of the way in which these cold collections of pus can sometimes be cured without such a radical method of treatment, I did not adopt drastic measures, but was content to do the best I could by emptying the joint with the aspirator, allowing the patient still to get about; and so far as this case went it answered remarkably well—a fact worth bearing in mind, because it emphasises a point which I often lay stress upon—that it is not essential in all cases to follow slavishly a routine treatment, such, for instance, as freely laying open a joint merely because it contains pus.

I have seen only one other case of painless purulent effusion like this into a joint. The circumstances were very much the same, and in that case also a quantity of perfectly sterile pus was drawn off. The patient recovered with a sound knee.

A large experience of the conditions in which painless effusions occur leads me to the following conclusions :—

- (1) Painless effusion into the knee-joint is primarily the result of constitutional conditions or defective structural arrangement.

(2) In the absence of increased local heat, injury need not be considered as a cause, excepting in the case of great looseness of the joint, and in tall, growing youths, when excessive exercise may be followed by transient effusion.

(3) Whilst the treatment in all cases of painless effusion without increased heat should be locally directed to the avoidance of muscle-waste and rectification of laxness of the joint by massage and exercises, a permanent cure can only be attained by the intelligent management of the primary defect.

(4) There is no reason for suspecting tubercle as a cause of painless effusion, no matter how long it may exist or how resistant it may be to treatment, unless there is persistent increase of local heat.

CHAPTER VI

RECURRING EFFUSION INTO THE KNEE-JOINT AFTER INJURY

RECURRING effusion into the knee after injury is a comparatively common affection, and one which is frequently overlooked on account of the very small amount of discomfort or inconvenience which it may cause, until distinct and sometimes serious changes have taken place in the articulation. By recurring effusion is meant an effusion which recurs after an interval or intervals (the effusion following immediately after the injury having entirely disappeared), during which the articulation, so far as can be seen, resumes its normal state. Before ascribing these recurring effusions to a traumatic origin care must be taken to be sure that the injury is the cause and that it is not merely the means of calling attention to an unsound condition previously existing.

The limitation of cases of this kind to those in which the joint in the intervals between the recurrences is apparently sound excludes for practical purposes tubercle, as in tuberculous disease, although

recurring effusion may at first sight seem to occur, the recurrences are in reality exacerbations only because during the intervals the joint does not become altogether free from evidence of abnormality, especially in the matter of increased local heat.

Cases of recurring effusion may be for clinical purposes divided into two classes—those entirely independent of constitutional defect, and those in which constitutional conditions may be fairly held to have an influence tending to produce the condition.

In a series of nearly 1000 cases which passed under my observation about two thirds were traumatic, the effusion being dependent upon mechanical causes in perfectly healthy people, males naturally being in the majority.

The causes of the recurring attacks in these cases are displacement of semi-lunar cartilages, hypertrophied synovial fringes or folds, loose bodies in the joint, general looseness of the articulation usually resulting from the neglect of massage and exercises, or the too long immobilisation in the treatment of the original injury; and in rare cases genu valgum.

The main symptom complained of is a general feeling of weakness in the knee. On careful inquiry the recurrence can generally be traced to over-exercise or unusual exertion, and occasionally to some slight and at the time unnoticeable injury—generally a

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twist which would be altogether too trivial to harm a normal joint.

Upon examination either during a recurrence or in an interval the joint will be found looser than normal, there will be abnormal lateral and rotatory movement, the thigh and buttock muscles will be more or less wasted, with a resulting general want of tone throughout the limb.

The treatment consists first in the restoration, if possible, of the wasted muscles and the general tone of the limb by massage and resistance exercises, or by the use of a mechanical exerciser like that shown in Fig. 5. Should the normal tonicity of the joint not be restored by these means and the attacks of effusion still recur, all unnatural lateral and rotatory movement in the joint can be prevented by the instrument made by Ernst (Fig. 4), which will allow practically every movement to be made with freedom whilst the abnormal looseness is corrected. In healthy subjects, especially when on the younger side of middle age, it is far better, when the massage and exercise treatment fails, to have an exploratory operation upon the joint with a view to the removal of any mechanical trouble which may be present inside the articulation—an operation which, if done with proper precautions by a competent surgeon, should entail a hardly appreciable risk. In 34 cases of this kind in which an exploratory operation was performed I found mechanical defects (detached

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semi-lunar cartilage, pedunculated bodies, loose bodies, or hypertrophic folds of synovial membrane) in 28 ; in the remaining cases no cause was found, but with one exception no further attack of effusion followed after the operation.

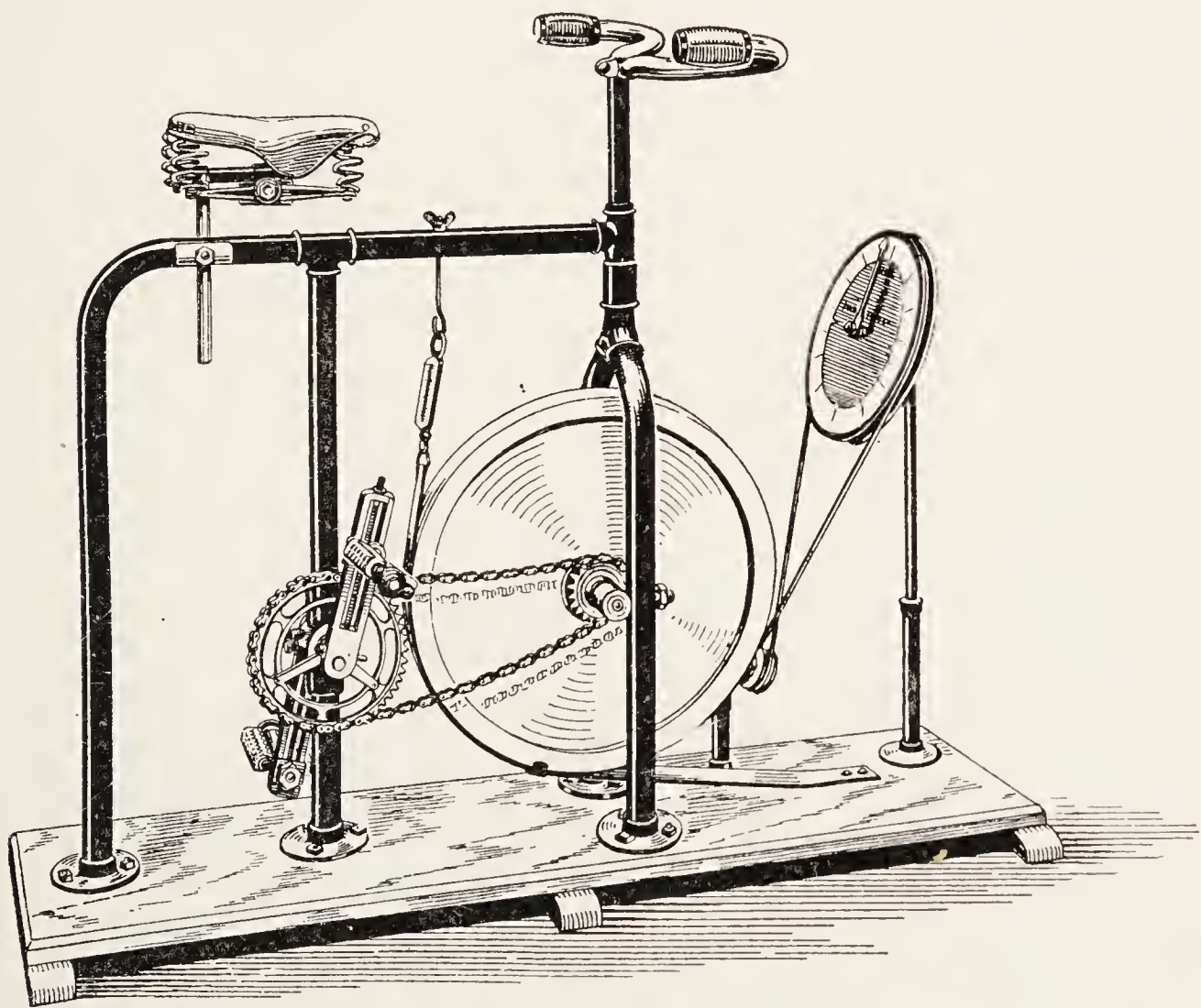


FIG. 5.—Spencer's stationary cycle exerciser, which is especially useful in restoring the normal condition after wasting of the muscles of the thigh in connection with knee-joint lesions.

The existence of a constitutional dyscrasia would naturally influence cases of the kind we are considering (1) by leading to the recurrence of effusion from very slight causes, and (2) by rendering recovery difficult or impossible unless the consti-

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tutional condition be treated, or at all events taken into account—a matter which is also of consequence in relation to prognosis.

Apart from the catamenial and uterine disturbances, already dealt with in Chapter IV, the commonest constitutional influences met with are, in my experience, the following in their order of frequency :—

- (1) Osteo-arthritis (so-called).
- (2) Rheumatism and gout.
- (3) Syphilis (ancient).
- (4) Auto-infection from the gastro-intestinal tract.
- (5) Gonorrhœal “rheumatism.”
- (6) Malaria.
- (7) Tubercle, rarely, for the reasons already stated.
- (8) Hæmophilia.

As any of these conditions may, of course, give rise to effusion without the intervention of injury, exception may be taken to including them in the consideration of recurring effusion following upon injury, but these, which form approximately one third of the 1000 cases or thereabouts upon which these remarks are based owed their origin purely to injury, the constitutional defect stepping in subsequently only either to cause a recurrence of the condition or to hinder its cure.

With regard to the cases (nearly half) in which osteo-arthritis was the factor, all, when first

coming under observation, were very early instances of the disease—in fact, in about 50 per cent. of them the diagnosis was only arrived at with certainty after repeated recurrence of effusion had been followed by some characteristic sign of articular change. The initiating injury was invariably slight and generally indirect—*e. g.* a twist or sprain. In a number of cases, all other treatment having failed to effect any useful purpose, exploratory operations were performed; in only two of these had any evidence of a loose body been found before the treatment; in the remainder attacks of acute pain, in some cases leading to sudden falls, led to operative investigation; in all the cases explored loose bodies were found and removed through a longitudinal incision at the inner side of the joint. As would naturally be expected, males were affected largely in excess of females—about four to one, the right knee being concerned more frequently than the left. When the second knee became involved it was invariably the result of some twist, strain, or stumble in attempting to “save” the faulty knee.

With regard to the treatment of the cases in which operation was not called for, nothing seemed to have more than a palliative effect excepting obstructive induced hyperæmia or the radiant heat-bath, massage and vibration, which in twenty-three cases of comparatively recent origin appeared to effect an actual cure. In a certain percentage the

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pain at the onset of effusion was very great, but as a rule it rapidly subsided. When persistent a gentle application of the thermo-cautery over the seat of intensity was followed by remarkable relief, excepting in the cases where a loose body was subsequently found to account for the symptoms.

Nothing of much practical interest arises in the cases associated with rheumatism and gout. Effusion occurring in gouty subjects commonly follows a direct injury; whilst that in which rheumatism is a factor an indirect injury is the usual cause. The gouty instances are usually characterised by some redness of the skin and acute sensitiveness to pressure, the effusion being generally rapid and excessive; in two cases which came under observation the suggestion of suppuration was very distinct, and would certainly have been alarming had not the history of acute gout in other joints been forthcoming—indeed, in one of these cases incision had been seriously considered. In the cases in which rheumatism is clearly a strong factor a cure is, as a rule, effected by the usual constitutional treatment combined with massage, with or without induced hyperæmia.

As a means of relieving tension and so alleviating pain in very acute conditions, the ordinary means having failed, aspiration is a sure resource, care being taken in gouty cases to carefully avoid any red area of skin in introducing the trocar.

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In the cases which I have seen in which the constitutional factor was syphilis, the longest period between the original infection of the constitutional disease and the receipt of the injury causing the effusion into the knee was twenty-eight years, the shortest period being three years ; in all the syphilis appeared to have been properly treated and to have been "cured." The injury in all the cases was direct, and as a rule slight ; the right knee, as would be expected, was much more frequently involved than the left in the proportion of rather more than 2 to 1. In no case was permanent benefit derived until a course of anti-syphilitic treatment had been adopted. In some it was the inveteracy of the condition which led to the searching inquiries which elicited the history of syphilis.

All the patients coming under notice who had suffered from gonorrhœal "rheumatism," in whom the recurring effusion followed some distinct injury, had suffered from "rheumatism" after gonorrhœa within three years, but were, so far as they knew, well until the injury started the effusion into the joint ; the injuries were in the majority indirect, and in each case the affected knee had been concerned in the gonorrhœal infection. In one case in which both knees were injured at the same time, one very severely, the other slightly, the former recovered rapidly and completely, whilst the latter, which had been affected at the time of the gonorrhœa, developed

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very inveterate recurrent attacks of effusion. In half of the cases there was an obvious gleet, although the patients were unaware of the fact. In the cases in which operations were performed to relieve tension and acute pain, aspiration effected the object as perfectly as incision, whilst it was less inconvenient, there being, of course, no wound which required treatment.

Malaria as a factor in producing a tendency to recurrent effusion after injury, is a matter of some importance. I have seen no less than twenty-two cases in which the recurrence was, so far as could be made out, due to this dyscrasia, the majority having been met with during the South African War 1900–1903. I have, however, seen several cases quite recently. In all the cases there had been attacks of malaria for some years, and in none had any joint affection been noticed until the receipt of an injury causing in the first instance some swelling of the articulation. Subsequently, although the joints appeared to have regained the normal condition, succeeding attacks of “fever” were accompanied by effusion into the joint which had been injured. This behaviour of joints under the influence of malaria after injury, although comparatively new to me, may possibly be familiar to those who are more intimately associated with tropical disease. The tension in some of the cases was extreme and the pain acute, in two aspiration was followed by immediate relief,

the remainder subsided under the ordinary remedies for the malarial condition.

It is, I suppose, by this time a matter of common knowledge that synovial effusion into joints, especially the knee, is not uncommon during malarial attacks with very high fever, although it frequently seems to escape notice.

Auto-infection from the gastro-intestinal tract is becoming more and more familiar as a cause of joint affections, and it will be found, unless my experience is at fault, that in patients suffering from colitis and other similar conditions of the alimentary canal attacks of joint effusion are frequently met with, being commonly classed as due to gout, rheumatism, osteo-arthritis, etc. In such conditions of the intestinal tract it will frequently be found that a cure of an injured joint is not only more difficult at first, but is also more liable to be followed by recurring effusion than in patients unaffected in this way.

The few cases of hæmophilia which I have met with as a cause of recurring effusion after injury have been of no particular interest, excepting one, in which, after three attacks of effusion following injury, a fourth occurred with so much tension and fever that it became desirable to ascertain the nature of the fluid; it was only upon the withdrawal of a large amount of blood that the diagnosis was made; the joint re-filled, but not to the extent it had

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done before the puncture. In none of the cases had there been any other joint involved; in one case (that which was aspirated) the usual family history of hæmophilia was not forthcoming.

That the altered mechanics of the knee met with in some cases of genu valgum should lead to a tendency to effusion after injury is not surprising, indeed, it is on the whole remarkable that the articulation in even extreme cases of this deformity is so rarely the seat of effusion. Should recurring effusion cause material inconvenience the indication is obviously to correct the deformity by osteotomy or otherwise.

CHAPTER VII

PAIN IN AND ABOUT THE KNEE WITHOUT SWELLING OR OTHER OBJECTIVE ABNORMALITY

PAIN in or about the knee without any obvious abnormality is a comparatively common cause of advice being sought by patients. It may arise spontaneously or continue after recovery from injury or disease.

For clinical purposes it is important to distinguish between pain arising from causes in or immediately about the joint and that which is referred to the joint by causes more or less remote from it.

Although the pain is generally described at first by patients as being "in the knee," it is not difficult to divide the pain, from the characteristics ascribed to it, into three types according to the region it affects, viz. that immediately above the joint, that immediately below, and that in the articulation itself. Speaking generally, the pain in the joint itself, although not associated with stiffness, is intensified by certain movements.

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Pain in the immediate neighbourhood of the joint.—
In young subjects, especially at and a little after the adolescent period, pain about the lower part of the knee is very common, particularly in those who are very energetic and given to excessive exercise. The pain can be localised around the upper edge of the tibia, and is usually associated with some tenderness over the tibial tubercle and the lower end of the ligamentum patellæ—in exaggerated cases swelling over this spot from bursitis occurs, a condition which excludes them from the present discussion. This pain is due to irritation of the epiphysial line, due mainly to the tugging of the patella's tendon in violent movements of the thigh upon the tubercle portion of the upper tibial epiphysis; it sometimes originates in a blow, *e. g.* a kick at football upon the tubercle, but indirect causation is the rule. It is increased by much exertion as might be expected, and becomes comfortable during rest. Once established, it rarely entirely disappears until growth has ceased—in other words, until the epiphysis has become ossified. The trouble is, in truth, the old-fashioned “growing pain”; little harm seems to come of it and no treatment but rest is of much use, and even after quite a prolonged period of rest the symptom is liable to recur after the first attempt at anything like real exercise. As a rule, therefore, methodical treatment need not be adopted; a guard should be worn over the tubercle during football or

in any other circumstances which may lead to injury.

When occurring spontaneously in listless or lazy subjects without evidence of injury or over-use this pain is of more consequence, as it may be the earliest indication of tuberculous disease. The cause of the pain being as I have indicated it is natural that a similar irritation of the lower femoral epiphysis should not be met with. A pain of a similar kind is, however, not infrequently complained of by growing subjects about the upper and posterior part of the internal condyle which is due to irritation of the epiphysis of the adductor tubercle from muscular action in energetic people, especially when riding. Pain of a nearly similar kind in adults may be due to chronic osteitis, syphilitic or otherwise, endosteal sarcoma, and to the so-called "fibrous" rheumatism. In adults, however, care must be taken to eliminate the possibility of bursitis about the tendon of the popliteus or semi-membranosus—conditions usually easily recognised by the fulness and characteristic tenderness peculiar to each. In connection with pain immediately below the knee, and often described as being in the joint, the near existence of the tibio-fibular joint, with its liability to the diseases and injuries common to all joints, must not be forgotten. Pains about the outer side of the knee following upon heavy falls upon the feet or wrenches of the leg are more often due to sprain of the tibio-fibular

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joint, or to fracture close to it, than is commonly understood.

A pain in this region sometimes develops in golfers and in those following any occupation entailing a continual swing of the body to an extent which strains the peroneal nerve as it passes behind the fibula to reach the under-surface of the peroneus longus muscle, but this pain differs from those now dealt with in shooting down the leg along the course of the nerve-branches when strain is exerted in the right way.

Persistent pain localised about the upper part of the knee, *i. e.* in the condyloid portion of the femur, should be regarded with suspicion; in young subjects it is sometimes the earliest indication of commencing tuberculous disease about the femoral epiphysis, the early stage, in fact, of what used to be called popliteal necrosis, and on the other hand it may in later life be the danger signal of commencing endosteal growth. For instance :

CLINICAL EXAMPLE No. 11.—A very robust-looking man, aged thirty-four years, complained of continual pain in the knee; this upon inquiry was localised immediately above the joint, the movements of which were perfectly free and did not affect the pain in any way. The walking powers were not interfered with, fifteen to twenty miles a day being easily accomplished, although when very tired by walking he certainly felt the pain rather more, and it then

kept him awake at night. Treatment having failed to bring about any amelioration in the symptoms I had an opportunity of examining the part, which to the sight and touch was absolutely normal. An X-ray investigation, however, readily showed an endosteal growth near the posterior surface of the femur just above the condyles; towards the popliteal space the bone bulged backwards, but not enough to be detected by palpation.

Apart from the mere clinical interest of the case it affords an admirable lesson in showing the desirability of the use of the X rays in cases of bone pain, however unlikely it may seem that they will "show anything." Failing the evidence of the X rays, had these symptoms occurred in a sensitive or nervous woman the temptation to ascribe them to psychic or "hysterical" causes would have been great.

Pain in the joint itself without other abnormal symptoms is most commonly due to early rheumatic conditions or to commencing osteo-arthritis. The relation of the latter to the movements of the joint is interesting. In the early stage the movements are affected in two ways, the pain being increased by extreme flexion in the one and by full extension in the other, intermediate movement being free and normal. In the former case it will be found that the formation of a popliteal bursa is almost invariably the first sign of coming objective change in the joint, in the latter the disease is of the type

in which hypertrophied folds and vegetations are early factors, the increase of pain in full extension being due to compression of these abnormal structures in the anterior part of the joint by the articular surfaces, which sometimes makes complete extension impossible, the symptoms then presenting the usual character of extraneous material between the bone ends.

In young subjects the effect upon the pain produced by pressing or rubbing the patella upon the subjacent bone in extension of the leg should be noted, and, if the pain is thus materially increased, a careful watch should be kept upon the case. In at least two instances of this kind I have seen tuberculous disease develop, the disease having commenced either in the patella or in the synovial apparatus immediately in relation with it. In one of these the patella was removed sub-periosteally.

One of the remote effects of injury to the knee is acute pain in the joint on abrupt rotation of the leg upon the thigh, which may be taken with certainty to mean an abnormal looseness of a semi-lunar cartilage. In such cases there is a strong liability to semi-lunar displacement, the only certain prevention of which is removal of the abnormally loose structure or the wearing of an appropriate apparatus. In every case of persistent pain in the joint the possibility of a foreign body, such as a needle, must not be entirely excluded even if the patient may have

no knowledge of any circumstance which could have led to its entrance.

CLINICAL EXAMPLE No. 12.—A man, aged thirty-six years, complained of a sharp pain across the front of the patellar region after walking, and when the leg was completely flexed. So far as he knew he had met with no accident or injury. As no objective signs were forthcoming an X-ray examination was made, with the result that two small shots were seen embedded in the parts behind the patellar tendon. On subsequent examination some tenderness was elicited over the situation of one of these; this was removed, complete relief following. The patient afterwards remembered that when rabbit shooting, many years before, he had been hit.

Pain arising from causes remote from the knee — This is, in some respects, the most interesting and at the same time the most puzzling of all varieties of pain about the knee; at times the diagnosis requires the greatest acumen, the joint itself affording no clue whatever in solving the problem, as it is entirely normal in feel and movement. In all cases of pain in the knee, when the joint is normal to the touch and to the eye, and is at the same time perfect in all its movements, it should be a standing rule, to which there must be no exception, that the diagnosis is incomplete unless a careful examination of the whole limb has been made. In order to fully appreciate the bearings of this variety of pain

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the following points relating to the nervous supply of the knee are worthy of emphasis: (1) Three of the articular nervous branches entering the joint for its supply, viz. those derived from the obturator, from the nerve to the vastus internus, and from the nerve to the vastus externus, arise remotely from the joint, the first of them crossing the hip-joint above; of the other two, one lies on each side of the lower third of the femur, separated from it by the muscular fibres of the vasti, and enters the knee-joint on its corresponding side. (2) Lying along the inner side and a little behind the knee is the long saphenous nerve, which, at the level of the joint, gives off a transverse branch (the nerve cutaneus patellæ) crossing the front of the knee to get to its outer side, to communicate with the middle and external cutaneous nerves, contributing there to the formation of a plexus (the patellar plexus) which receives above filaments from three branches from the cutaneous portion of the anterior crural nerve. With these facts in mind it is not difficult to imagine how a condition in Scarpa's triangle, involving the anterior crural nerve, may lead it to express its pain over the region of the knee.

The most familiar of all cases of pain affecting the knee from remote parts is that occurring in early hip disease, which is referred to it by the obturator nerve. Of an interesting and less familiar type of case the following is an instance:

CLINICAL EXAMPLE No. 13.—A middle-aged man, in attempting to keep his seat on a restive horse felt “something give way” at the inner side of the thigh or knee—he was uncertain which. Acute pain immediately followed upon any movement of the knee, especially extension. A good deal of bruising along the inner side of the thigh and knee followed, but with rest and soothing applications he appeared to have recovered in about a fortnight, although the thigh muscles were much wasted. Soon after attempting to get about again he noticed that any twist of the leg, *e. g.* during golf or in attempting to grip a horse, caused sudden acute pain in the knee, which he referred to the situation of the internal semi-lunar cartilage. It was therefore thought that the semi-lunar cartilage was at fault, and he came under observation with a view to the removal of the defective part. As in some respects the symptoms did not quite tally with those of internal derangement, a complete general examination of the limb was made. The thigh was wasted throughout; over Hunter’s canal there was sensitiveness, and upon pressure the pain complained of occurred in the knee. Further examination elicited signs of irregularity in the muscle surface, and at that point the pain in the knee could be produced by very slight pressure. It was therefore clear that some rupture of the muscle must have happened which involved the muscular branch of the vastus internus

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muscle and so led to the transferred pain in the knee. Massage and exercises produced a cure in about six weeks.

In this instance the pain was, as is usually the case, transferred from the centre to the periphery, but the reverse may be the case; for an example, irritation of a peripheral nerve in the foot may produce a pain apparently in the knee-joint. The best illustration with which I have met of this is the following, which I recorded in a lecture in the 'Lancet' of February 2nd, 1907.

CLINICAL EXAMPLE No. 14.—A well-known medical man had for some time suffered from sudden attacks of pain, which he attributed to recurring displacement of a semi-lunar cartilage. The attacks, as a rule, seized him suddenly whilst turning quickly round or when walking on uneven ground. So acute was the pain that it caused him to stop walking for a few minutes, when it gradually disappeared. No effusion into the joint had been observed and no noticeable mechanical locking had occurred. Such arrest in the movements of the joint as happened seemed to be due solely to the acuteness of the pain. The trouble became so serious that he was induced to consult me with a view to the removal of the defective cartilage. Although the history given would fairly fit certain cases of knee-joint derangement, I was rather sceptical about the existence of this condition, because the knee was entirely normal, showing none of the

laxness which so far as I know is always associated with recurrent derangement. Further inquiries elicited the fact that the attacks occurred only whilst boots were being worn—rather a suggestive thing seeing the frequency with which the attacks happened. Following upon this indication an examination of the foot revealed a sensitive corn, pressure upon which caused an attack of pain exactly like those referred to. Modification of the boot pressure soon led to the disappearance of the deceptive symptoms.

As the converse of this transference of pain to the knee from lesions in remote situations, it is well to remember that symptoms of nerve injury at the level of the joint may be emphasised in distant parts; for example, in a case of comparatively trivial injury to the peroneal nerve behind the head of the fibula the only symptom was acute pain along the outer side of the foot upon genu-flexion.

CHAPTER VIII

INTERNAL DERANGEMENT OF THE KNEE-JOINT, COMMONLY CALLED SLIPPED CARTILAGE

I

By this is properly understood a condition of looseness, detachment or other abnormality of one or both semi-lunar cartilages, usually arising from injury, which is liable to derange the mechanism of the joint in consequence of the displacement and intrusion between the bone ends of portions of the defective structures. As, however, symptoms for practical purposes identical may be produced in the same way by hypertrophied synovial folds and fringes, it is convenient for clinical reasons to include them in this definition as a cause of internal derangement. The use of the term "subluxation," which is sometimes applied to this condition, is unhappy and should be avoided, as it implies some displacement of the tibia from the femur in the horizontal plane—a defect which is conspicuous by its absence.

Damage to the semi-lunar cartilages or their attachments may safely be said to be responsible for a large majority of the cases of knee troubles following upon injury.

Thus I find in a large series of cases of affections of the knee-joint, consequent upon injury, there was evidence of the semi-lunar cartilage being apparently at fault in nearly two thirds. In 500 cases (418 males, 82 females) presenting characteristic symptoms of internal derangement, all cases which could be classed under the head of "loose bodies" having been excluded, the age of the patients varied from thirteen to seventy-two years. The left knee was affected in 346, the right in 154. The symptoms were referred to the inner side of the knee in 368 instances, to the outer side in 132. About 200 were seen after the original injury, and the remainder after recurrent attacks of displacement varying in number from one to twenty-two, exclusive of a few in which the attacks were said to have been innumerable.

Symptoms of displacement of the semi-lunar cartilages.—The symptoms usually recognised as characteristic of this lesion are, in the first instance, acute pain with or without a sensation of something having slipped or given way in the joint, with locking of the joint or limitation of the power of extension of the leg upon the thigh in any position between extension and semi-flexion, and tenderness along the line, especially at its anterior end, of the semi-lunar

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cartilage concerned. These symptoms may result from a violent wrench or blow, or may occur apparently spontaneously during some ordinary movement, such as rising from a kneeling position. Speaking generally, rotation of the leg upon the thigh is the movement mostly conducive to the production of the lesion. Rapid effusion into the joint may occur, being generally in proportion to the violence of the injury; when the displacement is spontaneous effusion is rarely more than slight, and is as often as not entirely absent.

Relief may follow almost immediately by spontaneous reduction of the displaced or slipped structure, or reduction may only be possible by manipulation, the successful performance of which frequently necessitates the administration of an anæsthetic.

In rare cases, locking in a position of flexion may occur and may not be confined to one limb; for an example, I have seen an instance in which after a fall downstairs both knees were fixed in a semiflexed position. Limitation of flexion to any great extent is, however, rare, the restriction of movement being principally limited to extension.

The cause of these symptoms in the grosser cases is obviously the intrusion or nipping between the bone ends of the detached or damaged cartilage. It is therefore clear that symptoms almost precisely similar may arise from any other condition in which nipping of structures between the articular surface may

happen. The only other structures liable to be thus affected are hypertrophied synovial fringes or folds and loose bodies in the joint.

For purposes of treatment the differential diagnosis between cases in which the semi-lunar cartilages are concerned and the other conditions causing somewhat similar symptoms is important.

It is essential to understand that in slipped cartilage the displacement is almost invariably inwards, the exceptions to this being very few; hence, contrary to what is generally assumed, the displacement of a semi-lunar cartilage produces no swelling outside the joint, but leaves, what is frequently only appreciable by a careful comparison of the two knees, a distinct deficiency above the anterior half of the edge of the head of the tibia on the side concerned. In some cases there may be a very slight fulness over the displaced part when the injury has been severe, but this is mainly due to blood extravasation, with or without inflammatory exudation. Projecting masses from the knee, therefore, are not strong evidence of cartilage displacement, as they are in fact almost always due to the projection of loose or pedunculated bodies, quite distinct from the semi-lunar cartilages.

The only differential symptom which can, as a rule, be relied upon with certainty as evidence of displacement of the semi-lunar cartilage is tenderness along the line of the structure concerned, especially at its anterior end; when the symptoms are caused by a

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synovial fringe or fold this tenderness is absent. In the localisation of this sign it is necessary to be very precise, or mistakes may readily occur. A striking instance is the following :

CLINICAL EXAMPLE No. 15.—A patient of middle age, who had on several occasions suffered from attacks of semi-lunar cartilage displacement, fell down some steps, and, on getting up, found it impossible to bend the faulty knee on account of acute pain at the outer side ; he therefore concluded that the cartilage had become displaced. Upon examination soon after the accident there was much effusion into the joint, and pressure along the line of the external semi-lunar cartilage caused pain. The joint was kept at rest until an X-ray examination could be made, when it was found that there was a fracture through the head of the fibula, pressure upon the upper end of which, in passing the finger along the semi-lunar cartilage, caused the pain.

A more remarkable case is this—

CLINICAL ILLUSTRATION No. 16. — A patient of middle age, who for some time had been suffering from symptoms of looseness of the external semi-lunar cartilage, that is to say, sudden attacks of pain which always occurred during some twisting movement of the leg, accompanied sometimes by locking of the knee, causing her on one or two occasions to fall, the attacks being followed by tenderness along the line of the joint on the outer



X-ray photograph showing a sesamoid bone which, by occasionally slipping out of position, caused symptoms resembling those of internal derangement of the knee-joint.

side of the usual kind. Upon examination there could be felt, on the outer and posterior part of the knee, above the level of the line of the joint, a "something" which slipped under the finger during the extension of the leg upon the thigh. An X-ray photograph (Plate III) showed outside the joint, in relation with the external condyle, a rounded opacity, a sesamoid bone in fact, which was obviously the abnormality noticed. The case is interesting as showing a rare condition simulating semi-lunar lesion, and it emphasises the folly of rejecting the aid of the X rays, because it is thought that they may show nothing. In this instance the patient had more than once suggested the use of the X rays, but was on each occasion advised against their use on the grounds that no information would be forthcoming.

Another condition—a very important one from a clinical point of view, although it is not commonly recognised—which may cause symptoms indistinguishable at first from displacement of the semi-lunar cartilage, is the swelling caused by bruising, generally by direct injury on the inner side of the knee, of the peripheral edge of the semi-lunar and its attachments without displacement or loosening, the immediate result being a local blood effusion, subsequently reinforced by inflammatory exudation, a portion of which, insinuating itself between the edges of the bones, acts as a foreign body, and frequently, I have no doubt,

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accounts for the symptoms in some of the milder forms of "slipped cartilage" which are frequently quite curable if properly managed, without leaving any tendency to recurrence, for the following reason. The essential symptom, it is hardly needful to repeat, is in all cases of internal derangement the fixation of, or at all events limitation of movement in, the joint, resulting from the existence of foreign material between the bone ends. If the extraneous substance be a portion of a semi-lunar cartilage, loose body, or fold of synovial membrane, the symptoms are very pronounced, but they disappear at once after reduction has been effected, whether the reduction occurs spontaneously or is brought about by manipulation, the movements of the joint being immediately recovered. The only positive evidence of successful reduction lies in the ability to extend the leg upon the thigh as completely as in the sound limb; anything short of this is held to show that some mechanical obstacle in the way of foreign material lies between the bone ends. Unless my experience is exceptional it must have been noticed by others in many cases of the milder sort, in which the limitation of movement is only slight, that although the symptoms are precise enough the limitation in the extension of the leg cannot be rectified by manipulation, however carefully it may be carried out; "reduction" of the "displaced" material cannot, in fact, be accomplished. Not only does the inability on the part of

the patient to completely extend the limb remain unchanged by the manipulation, but it will be found that even under an anæsthetic it is impossible to completely straighten it. It is true that if the patient, whilst anæsthetised, be laid on his back, the limb can be put practically straight if firm backward pressure be made upon the front of the knee; but upon removal of the pressure the knee immediately springs forward, leaving the limb bent to the same degree as before it was straightened in the manner indicated. The failure of attempts at "reduction" in these cases is due, not necessarily to any want of skill in the manipulation, but to the fact that there is nothing present which in the ordinary sense is reducible. In spite of the apparent intractability of these cases at first, they invariably recover completely if properly treated, and show no tendency to recur. The important point to notice in their progress is this: the recovery of complete extension is gradual, never sudden, as is the case when a foreign body has been withdrawn from between the bones. In these cases the symptoms arise from the swelling due to bruising and laceration about the peripheral margin of the semi-lunars and their attachments without displacement, the gradual recovery of free movement being due to the slow absorption of the effused products. The gradual way in which the normal state is regained is in itself enough to negative the existence of anything like a foreign body, in the ordinary sense of the

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term, between the bones, and the nature of the treatment by which recovery is brought about, added to the absence of any tendency to recurrence in properly managed cases, is strongly corroborative of this contention. In the following case the condition was revealed by operation.

CLINICAL EXAMPLE No. 17.—A soldier, about thirty-two years old, after a wrench of the left knee suffered from the usual train of symptoms associated with “slipped cartilage”—*i. e.* sudden pain, tenderness over the internal semi-lunar cartilage, and inability to straighten the limb completely at the knee. Attempts were made by an onlooker to “put the knee in,” but without success. The patient, however, continued to get about with a partially stiff limb, and shortly afterwards, no proper treatment having been adopted, he was ordered on active service. With the knee in the condition indicated he, with difficulty, got through a campaign of some months’ duration. From time to time, after some strain or injury, an acute sudden attack of pain, followed by effusion into the joint, occurred. I saw the patient about six months after the original injury; during the whole of this time the leg had never been completely extended upon the thigh. There was some effusion into the knee with increase of local heat; the joint was slightly flexed, and could not be extended either by the patient or by passive movement. Over the middle of the internal

semi-lunar cartilage was a spot of acute tenderness ; a little fulness was also distinctly felt. From this tender spot the acute pain which followed upon any strain or other injury always started. After the treatment, which I shall presently describe, the knee had nearly regained, by degrees, its natural state, extension being almost complete, when, unfortunately, another strain reproduced the old condition. Subsequent attacks of the same kind followed, and it was evident that, unless the abnormality could be cured by operation, service in the army must be abandoned. I therefore operated with the usual precautions. The parts about the base of the semi-lunar cartilage, inside the capsule of the joint over the tender area were swollen and infiltrated with blood (some of long standing) and exudation products. The cartilage itself was not detached, and clearly could never have been displaced. Before removing the affected parts an attempt was made to extend the limb, the capsule, of course, being freely open, without success. After the removal of the swollen tissues, including the portion of cartilage involved, it immediately fell into a perfectly straight position. A portion of the swollen mass which could be seen lying between the bones at the posterior part consisted of organised blood-clot. The cartilage itself was hardly recognisable at first in the centre of the mass removed, as it had entirely lost its ordinary aspect, and resembled, more than

anything else, both in appearance and to the touch, a piece of sodden felt; in front and behind this the structure differed but little from its usual anatomical characteristics. Creeping over the surface of the internal condyle for a distance of at least half-an-inch was a delicate layer of pink granulation tissue, beneath which the articular cartilage was eaten away. From the general aspect of the case it was manifest that the condition, if left to itself, must have developed sooner or later into general disease of the knee-joint. The altered cartilage having been removed and the bones cleared of old blood-clot and exudation tissue, the wound was closed in the usual way. The progress of the case was naturally tedious, and altogether caused me more anxiety than any other case of the same kind with which I have had to deal. The final result was good, and the patient re-joined his regiment in about four months.

In another case, less advanced than the one just detailed, the condition of the parts and the appearance of the cartilage were precisely the same.

In three other cases in which a displaced semilunar cartilage had been neglected, the structure presented the same sodden felt-like appearance. This felt-like condition seen in some of these cases is of considerable interest, as it shows without doubt that the cartilage must either have been completely crushed at the time of injury, had become changed

in consequence of subsequent inflammatory processes, or had become altered in consequence of the constant grinding pressure to which it had been subjected. Of this peculiar change in the semi-lunar cartilage I find no mention in surgical literature, but I am informed by an eminent surgeon that he has met with cases of the kind. The recognition of this bruising and laceration about the semi-lunar cartilage, without displacement as a cause of the symptoms commonly associated with "slipped cartilage," is of considerable moment in the treatment of such cases, as will presently be seen.

In cases of recurrent displacement the following points will generally be noticed: (1) The tendency to recurrence is in direct proportion to the looseness of the knee-joint, and the defective condition (wasting) of the muscles of the thigh. (2) With repeated attacks the effusion, when a noticeable symptom, gradually tends in the majority of cases to diminish with each attack until in many cases it is no longer seen. (3) The severity of the injury, or the violence of the movement necessary to produce the symptoms, diminishes with successive attacks. (4) In a certain proportion of cases occasional recurrence of effusion with a feeling of weakness is the only symptom, neither pain nor limitation of movement occurring. (5) In course of time in a certain number of cases the attacks, although they occur frequently, cause so little in-

convenience and the displacements of the cartilage are so readily reduced, either spontaneously or by a slight twisting movement of the knee, that little or no disability arises under ordinary conditions. (6) If the displacement of a semi-lunar cartilage be so great that it lies in the intercondyloid notch all symptoms of abnormality may disappear, complete recovery having apparently taken place. Of this last condition the following is a striking instance :

CLINICAL EXAMPLE No. 18.—A man, aged thirty years, in alighting from an omnibus twisted his right knee, which immediately became fixed and swollen, presenting, in fact, the usual symptoms of displacement of the semi-lunar cartilage. He had always been previously well, excepting after an accident during football at the age of seventeen, when he “slipped a cartilage” in the same knee, which gave him trouble from time to time for three years, after which it caused no inconvenience, and he thought nothing more of it, considering himself absolutely sound. The usual treatment having failed to restore the knee to anything like its usual state, an operation was performed, and the internal cartilage was found split, and partly caught between the bones. The damaged structure having been removed, and the natural movements of the joint restored, a thick rounded cord was seen lying along the middle of the joint under the intercondyloid notch, coming forwards from the outer side of the crucial ligaments.

The external semi-lunar cartilage was then found to be wanting in its normal site, and was in fact represented by the rounded cord, which must have occupied the position mentioned since the supposed recovery of the knee many years ago without having caused any trouble at all.

It is singular that in spite of the frequent recurrence of attacks of displacement, many followed by inflammatory developments, *e. g.* synovitis, etc., that tuberculous disease of the joint can so very rarely be traced to cases of this kind. I have myself in the course of a very large experience no recollection of more than two cases of tuberculosis which could have been said with certainty to have originated in the condition.

The main results in neglected cases are increasing looseness and instability of the joint in consequence of excessive wasting of the thigh muscles, which in extreme cases may render the limb useless without instrumental support, and the gradual development of osteo-arthritis, so called, with a special tendency to the formation of synovial extension cysts.

CHAPTER IX

INTERNAL DERANGEMENT OF THE KNEE-JOINT

II

THE immediate indication in every case of this injury is reduction of the displacement of the cartilage ; unless this has already occurred spontaneously, the sooner reduction is effected the better. There is no excuse for delay, and the longer the attempts to correct the displacement are postponed the more difficult does reduction become. The surest way of effecting reduction seems to be flexion of the leg upon the thigh and the thigh upon the pelvis as completely as possible, the leg whilst this position is maintained being rotated strongly outwards and inwards, rapid extension of the whole limb following. Successful reduction is followed by disappearance of pain, the return of full power of extension, ability to bear heavily upon the limb in standing without causing pain in the joint, and absence of pain upon quickly rotating the tibia upon the femur, which in

these circumstances is best effected by moving the foot sharply from side to side. Should pain in the joint on standing persist or pain on rotation be present the probability of extraneous matter between the bone ends is very strong. This proceeding, if reduction without operation is possible at all, very rarely fails to attain the end in view. Should it fail a further attempt at reduction may be made by flexing the leg upon the thigh at a right angle, the thigh being vertical, and making a violent upward traction sufficient to lift the trunk from the table or bed; it is not needful to say that an anæsthetic is always helpful and frequently necessary. Should all attempts at reduction with or without an anæsthetic fail an operation for the removal of the offending structure, unless some urgent reason of health or expediency stands in the way, should be performed as soon as, but not before, all effusion into the joint which may have followed the injury has disappeared.

In determining whether reduction has been completely effected or not it must be borne in mind that, as has already been shown, in some of the cases when the limitation of extension is very slight the cause of the defect is merely swelling of bruised or lacerated parts, in which circumstances no manipulations can from the nature of things immediately restore complete movements; a persistence of attempts at reduction in such cases can only do harm.

The treatment following upon reduction in all cases, whether they are those in which movement has been restored spontaneously or by manipulation, or whether they are of the kind in which some slight flexion exists in spite of attempts at reduction, is complete temporary rest by fixation of the joint on a light splint, a compress of warm water, or, as I prefer, since it is more soothing, one of hot *lotio plumbi cum opio* being kept continually applied. The period during which this rest is maintained varies from four days to a week—the time, in fact, which is usually occupied in getting rid of the effusion into the joint. The less the joint is subjected to movement until all effusion has disappeared the better is the chance of a perfect result finally. I am certain, from my own personal experience and from what I see and hear of the results of the practice of others, that nothing militates against a successful end in these cases so much as the use of exercises, passive or in the gymnasium, immediately after the injury. This is, indeed, in my opinion, quite the worst practice that can be adopted, since the commencement of exercises immediately, as is recommended by some, is, I have no doubt, at least as bad as the opposite extreme, in which a limb may be crippled by being kept at rest too long.

Although no movements of the joint should be commenced until all effusion has gone, massage of the muscles and the joint, without movement, cannot be

commenced too soon ; not only does the early massage expedite the disappearance of the fluid more than any other means, but it seems to check, if not to altogether prevent, the rapid muscle-waste ; and, what is most important of all, it greatly obviates the tendency to flaccidity of the capsule of the joint, which is such a fruitful cause of imperfect recovery in these cases. Nothing is more striking, I think, than the rapidity with which the muscles of the thigh, and, to a less degree, those of the leg, waste if left to themselves in this injury. In my practice, therefore, from the first, during the temporary rest, the limb is subjected to thorough massage without knee movement daily, and if the circumstances admit, twice a day. Upon the disappearance of the effusion, which in well-managed cases is rarely later than a week from the time of the injury, exercise by passive movement is commenced, care being taken that no rotatory motion is imparted to the leg. The avoidance of rotation is the essential point in these early movements ; in the gymnastic treatment this cannot be with certainty achieved. The rotation movements which are inevitable in the voluntary exercises commonly prescribed, directly bring about a looseness of the cartilage in the cases which originally are merely bruises or lacerations of attachments only, and in those in which there is originally displacement they tend to produce recurrence of the condition more certainly than any other means. It would be easy to give

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many examples in illustration of this point, but the one which follows will suffice :

CLINICAL EXAMPLE No. 19.—A soldier, aged forty-two years, had an undoubted displacement of the left internal semi-lunar cartilage ; this was replaced soon after the injury by the practitioner who was at first consulted, and the ordinary exercises of the gynasium were at once prescribed. At the end of a week the displacement recurred ; the pain was intense, complete extension being impossible ; reduction was attempted, but apparently without success, as no change in the condition of the limb followed. The exercises were continued and as much walking as possible was recommended. Six weeks later I saw the patient ; the leg was then considerably flexed and could not be extended by manipulation ; the knee was distended, and the pain on walking was acute. Rest for a fortnight, with massage without exercise, removed the fluid, and reduction occurred spontaneously whilst turning in bed. Recurrent attacks followed, and ultimately I removed the portion of the semi-lunar cartilage concerned. Not more than half an inch of the anterior end was detached, and I am strongly of opinion that if the case had been treated upon the lines which I recommend no operation would have been necessary.

The object of the temporary fixation and massage is first of all to remove the fluid, and secondly to allow the loose portion of the cartilage to fall back

and adhere in its normal site, which, with the help of the surrounding inflammation which almost always follows to some extent, it will frequently do. The passive movement without rotation, whilst it does not disturb in any way the process of re-fixation, prevents the formation of adhesions in the joint itself.

It is interesting, perhaps, to mention here, with reference to what has just been said about the effect of inflammation in the re-fixation of a loosened cartilage, that, so far as my experience goes, the cases in which the inflammation following immediately upon the injury is somewhat acute show less tendency to recurrence of symptoms, when the condition is adequately treated, than those in which the immediate inflammation is very slight or non-existent, which, if my view of what occurs is correct, is precisely what would be expected. At the end of a fortnight pedal exercises may be freely used, the massage being continued, and at the end of three weeks from the date of injury the patient, who has until then been walking with a "stiff leg," begins ordinary walking exercise. The time during which the massage must be continued varies in different cases from three weeks to six months, or possibly more. The time for its cessation is determined by the condition of the thigh muscles and of the capsule of the joint. Speaking generally, it may be said that in no case can it be considered safe to dispense with the treatment if the thigh muscles remain wasted, or if the

capsule is lax, the latter condition, which is practically dependent on the former, being the more important, as the lateral movement or "wobbling" of the joint which is associated with it is directly conducive to recurrence of the trouble in the articulation.

The importance of restoring the proper tone or tension of the capsule of the knee-joint in these cases is, I believe, not sufficiently appreciated, nor do I think the means of effecting this end are altogether a matter of common knowledge. It is too commonly known, I suppose, to need emphasis here that the normal tension or "tone" in the capsule of the healthy knee is greatly dependent upon the muscles in the thigh proper which send expansions to it, notably the quadriceps extensor. A factor, however, of prime importance in this matter is one which, judging from the way in which the treatment of these cases is frequently conducted, is not always held in sufficient esteem—I mean the ilio-tibial band (Fig. 2), the elastic tension of which is upheld by the gluteus maximus and the tensor fasciæ femoris (see Chapter I). It will be found in the majority of, if not in all, cases like those now under discussion, when the knee capsule is very lax and the lateral movements of the knee excessive, that there is marked wasting of these two muscles. Although much attention is generally paid to the wasting of the quadriceps extensor and to attempts to restore its normal condition, little account is, as

a rule, paid to the muscles connected with the ilio-tibial band. In attempting the restoration of the normal tension of the knee capsule by massage and exercise the treatment must not be confined to the obviously wasted muscles of the thigh, but must be applied with equal vigour to gluteus maximus and tensor fasciæ femoris, the muscles controlling the ilio-tibial band. The method described has, in my hands, produced the best results. It is open to criticism on the score of expense, and by some patients it may be felt unduly tedious. In any case, however, the essential points of the immediate treatment, viz. temporary rest for the joint, followed by gentle exercises without rotation movement, are not difficult to carry out.

The use of mechanical supports in internal derangement.—In the management of derangements of the knee no support or apparatus of any kind should be employed unless it is absolutely unavoidable. It cannot be emphasised too strongly that the use of artificial supports tends to render permanent the wasting of the thigh muscles—the thing of all others to be avoided—to a degree which varies with the kind of instrument adopted. Moreover, the use of mechanical help of any kind in the case of a patient whose treatment has been commenced immediately after the receipt of the original injury must be held to be sure evidence of the failure of the means primarily employed.

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The use of mechanical contrivances is justifiable only in the following circumstances: (1) Cases in which, for unavoidable reasons, the rational treatment is impracticable; (2) cases in which the rational treatment has failed to restore the normal tension of the knee capsule, or those in which abnormal lateral mobility remains to any marked degree in spite of this treatment; and (3) cases in which recurrent attacks of semi-lunar displacement having occurred frequently, operation has been for some reason rejected. If the symptoms point with reasonable certainty to the existence of a loose body in the joint, other than a displaced cartilage, the use of a mechanical contrivance is obviously futile, operation being the only method, short of fixation of the limb by an immobilising apparatus, which offers a prospect of relief. In the event of the use of a support being for sufficient reasons decided upon, the main point of importance is that it be constructed upon proper lines. All ordinary "knee-caps," whether of elastic or inelastic material, are to be avoided, as, whilst not in any sense providing the means for attaining the end in view, they tend more than any other contrivance to increase and perpetuate the wasting of the thigh muscles, and so contribute to the permanent weakening of the limb.

The objects to be attained by the use of mechanical means are the prevention of rotation of the leg upon the thigh, and, by adequately gripping the tibia

and femur, to rectify any looseness or tendency to abnormal lateral movement, to reduce, in fact, as much as possible the knee-joint to the condition of a true hinge. In the manufacture of apparatus these essential points must therefore be kept in view. There seems to be an impression amongst some of those who produce appliances for cases of this kind that a truss or pad may be made which will retain a loosened semi-lunar cartilage in its normal position; a moment's thought will, however, show that instruments devised for the purpose of keeping the faulty cartilage in position by merely exercising pressure over the apparently affected part must be useless in a general way, because the displacement is into the joint and not out of it, saving exceptional cases like that shown in Fig. 12, but even in such a case pressure would not retain the displaced structure in position during the free movement of the limb. All that can be effected by instrumental means is the prevention of lateral movement and rotation, whilst the free movement of the joint remains uninterfered with. After a large experience of matters of the kind I am driven to the conclusion that there is only one instrument (Fig. 4) which meets the requirements necessary. I have therefore ceased to use any other.

The operative treatment.—It cannot be doubted that the only efficient operative measure in these cases is the removal of the offending cartilages,

Table of Operations in a Series of 500 consecutive Cases of Knee-joint Trouble in which the Symptoms were suggestive of Internal Derangement.

Nature of operation.	No. of cases.	Sex.		Side.			Remarks.
		M.	F.	Left.	Right.	Both.	
Removal of pedunculated bodies; cartilages normal.	18	14	4	11	7	—	These cases all presented typical symptoms of internal derangement, occasional locking of the joint, etc. Ditto, with the exception of seven in which the only symptom was recurrent effusion. Ditto, with the exception of one case in which recurrent effusion was the only symptom. In one of these there were typical symptoms of internal derangement, in the other there was recurrent effusion only.
Removal of internal semi-lunar cartilage.	81	75	6	62	17	2	
Removal of external semi-lunar cartilage.	22	20	2	14	8	—	
Removal of both semi-lunar cartilages in the same knee.	2	2	—	1	1	—	
Totals	123	111	12	88	33	2	—

which in many cases affords the sole possible chance of providing a workable joint, and I have had no evidence to show that any defect in the mechanism of the joint after operation need arise from the absence of the cartilages even if both have been removed. At the same time I think that the percentage of cases in which operation is necessary should be comparatively small if the treatment of the original attack has been properly managed. Operation under ordinary circumstances should be postponed at all events until after the rational treatment described has failed. I have little doubt that if this treatment were properly carried out the operation method would be confined for the most part to the removal of pedunculated bodies and synovial folds, and that the semi-lunar cartilages would comparatively seldom have to be dealt with by operation.

The great difficulty which often arises, excepting in cases where the cartilage concerned can be felt to be absent from its normal site, in diagnosing exactly what the real cause of the trouble is without opening the joint, renders exploratory operation in intractable cases obviously desirable; it should, however, be reserved for (1) cases in which non-operative measures have conclusively failed to cure or sufficiently modify the symptoms to satisfy the patient. (2) Cases in which general flaccidity of the joint, as shown by an abnormal amount of lateral movement

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upon manipulation, is in excess of the other symptoms (I have already indicated the important part which this flaccidity plays in the ultimate result of the treatment of these cases), and the strongest indication for exploratory operation is afforded, in my opinion, by progressive looseness of the joint generally. It is at the same time well to note that these very loose joints, especially if the lesion involves the semi-lunar cartilage, are those in which the tendency to defective results after operation is strongest. (3) Cases of expediency in which immediate cure is urgently called for by special circumstances, such, for example, as may be the case with a soldier or any person in the public services, in whom the persistence of a physical defect may entail the relinquishing of his career, or, in the case of athletes, gymnasts, and the like; and (4) grossly neglected cases, in which, from long-continued inflammation, the joint has assumed a condition of chronic disease. Such cases are, however, rare, and indeed, in the true sense are outside the category, both clinically and from the operative aspect, of those now being discussed.

My reasons for restricting operative treatment to such a comparatively small number of cases are the following: (1) The majority of these cases are, I believe, curable by the means already indicated, and of the remainder many, although not curable in the true sense, can with or without suitable apparatus be

made of so little inconvenience that the majority of patients are too well content with their condition to submit to the inconvenience and the expense of an operation the result of which may occasionally be disappointing. (2) The operative measures necessary for dealing with some of these cases when the semilunar cartilage is at fault cannot be said to be entirely free from risk, for it is, I believe, a fact that although opening the knee-joint for the removal of loose bodies is rarely, if ever, followed by anything but uneventful recovery in competent hands, the removal of a semilunar cartilage is not always so free from subsequent trouble as is generally imagined. Personally I have until now had no disaster after opening the knee-joint (one instance excepted which occurred many years ago, in which direct septic infection occurred from causes beyond my control, in a case of a different kind to those now under discussion), but I cannot say that all my cases have been entirely free from symptoms of a disquieting kind following immediately upon the operation, the main complication being acute synovial effusion, which in a few cases has produced tension to an extreme degree, accompanied by high temperature, reaching as much as 102° and 103° F. It is foolish to pretend that the condition of the joint in these cases was not critical, and that unless very great care and discrimination in the treatment had been exercised, that the ultimate utility of the joint and perhaps the integ-

rity of the limb was not in grave danger. The risks are, of course, small and mainly accidental, provided that a rigorous asepsis is attainable and that no operation is performed whilst there is effusion in the joint. They are, however, I think, sufficient to call for consideration in the arriving at a decision as to operation *versus* the use of mechanical supports. (3) The results of operation are not always perfect apart from the very rare cases in which failure is complete, viz. those which end in a completely stiff joint or possibly in the loss of the limb. There is undoubtedly a certain percentage of defective results from (1) recurrence of symptoms and (2) partial stiffness. In my experience of operations for removal of one or both semi-lunar cartilages recurrence of symptoms occurred in two cases, the cause in one being the displacement of the second cartilage, which was apparently quite normal at the time of the operation for the removal of the one originally in fault, and in the other a growth of tissue into the joint from the line of the division of the synovial membrane at the previous operation.

Four cases in which I operated for recurrent symptoms after operation, the original operation having been done elsewhere, were exceedingly interesting, as they showed very clearly that the recurrent trouble was in each case due, not to anything connected with the cartilage, which had been efficiently dealt with, but to large hypertrophied folds of synovial

tissue behind the ligamentum patella, which from time to time became caught between the bone ends. These were cleared away, and the patients subsequently remained well.

The practical lesson which these cases very clearly teach is this: in any case in which a semi-lunar cartilage is removed the whole of the knee-joint should be carefully examined, and any enlarged synovial fringe or fold taken away, especial attention being paid to the hypertrophied tissues behind the ligamentum patellæ and lower part of the patella (the ligamentum mucosum and ligamenta alaria), which are the commonest causes of recurrent symptoms after these operations.

The only case in my own experience in which any material defects in the movement or strength of the joint followed the operation was that of a man who absolutely declined to have the necessary exercises to restore the full suppleness of the joint, the result being that the power of extension was not quite complete, and flexion beyond a right angle was impossible.

The method of operating and the subsequent management of the case.—In all the cases upon which I have operated for symptoms pointing to internal derangement of the knee-joint, the abnormal parts were removed through a longitudinal incision, from $1\frac{1}{2}$ to $2\frac{1}{2}$ inches long, commencing above about $\frac{1}{2}$ inch from the edge of the patella at its centre, and ex-

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tending downwards as far as a point a little beyond the line of the articulation. This incision gives ample room for every purpose, and through it may, if necessary, be removed both the semi-lunar cartilages, as was done in two of my cases. The incision is, of course, made on the side of the joint to which the symptoms point as the seat of the lesion. If there is reason to suspect the implication of both semi-lunar cartilages, the incision should be made on the inner side, as the external cartilage is more easily got at

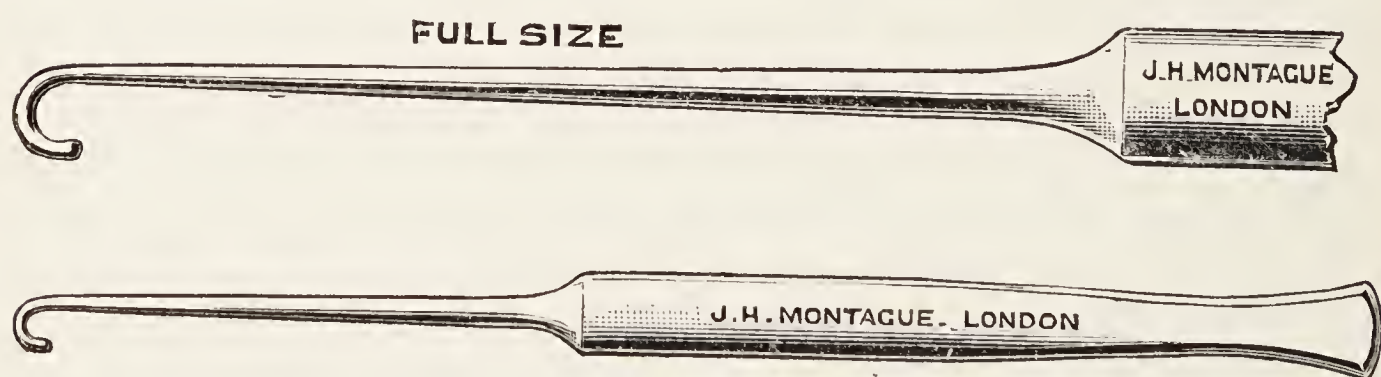


FIG. 6.—Small blunt hook used in removal of the semi-lunar cartilage.

from the inner side than is the internal from the outer side. In each of my cases in which both cartilages were removed, the second cartilage was readily drawn across the joint to the single incision by means of a small blunt hook (Fig. 6), and made accessible to the blades of a strong pair of scissors.

Contrary to the practice of some surgeons, I invariably examine the joint, before closing it, by introducing the finger through the operation wound. I have never known it to do harm, and I have on several occasions thus obtained information which

has enabled me to complete the restoration of the mechanics of a joint, which, failing such an examination, would certainly have remained defective.

For sewing up the wound in the capsule the finest catgut obtainable is, in my experience, the best suture, and I invariably leave a portion of this wound unclosed at its lower end, as in the event of effusion causing tension in the joint, the pain is, I find, less if a means of escape of some synovia into the surrounding tissues is left. The knee is packed in a voluminous dressing of double cyanide gauze and sterilised gamgee, the former being applied in a four- or six-yard length, lightly as a bandage. A splint is used only during the first twelve hours, as a precaution in case of trouble during the patient's recovery from the anæsthetic.

It is sometimes stated that no operation for internal derangement of the knee-joint should be considered complete when the joint is locked, or if extension is defective, unless extension to the normal limit is immediately possible, that the joint movements should in fact be as perfect at the end of the operation as those of the opposite limb. In cases of recent displacement of a semi-lunar cartilage this is true, but it is not so in old-standing displacement with restriction of movements—not a rare condition—when the mere removal of the mechanical obstacle does not always allow of immediate normal extension, although

it may be rapidly recovered by the aid of massage and exercises.

The fact that complete recovery of normal movement does not in some cases immediately follow the removal of the objective abnormality in the joint, although it may gradually ensue, has a practical bearing upon the transpatellar exploration—an entirely needless proceeding, in my opinion, which allows of nothing being done which cannot be effected through the incision I have indicated, which is well shown in the following case :

CLINICAL EXAMPLE No. 20.—A man, the subject of long-standing semi-lunar displacement, the knee being fixed in a slightly bent position, was operated upon by a surgeon of repute, the lateral incision being employed, and the displaced structure removed. Complete extension being still impossible, the joint was later on explored by the transpatellar method with a view to finding the obstacle to free movement. Nothing further was found, and the defective movement remained as before ; suppuration unfortunately followed, and a stiff joint in the same slightly bent position resulted. The transpatellar exploration was obviously superfluous here, and had the operator been content with the slighter operation, complete movement would have been almost certainly obtained by the usual means—at least, such is the conclusion to which my experience in these cases leads me. I very much doubt whether any obstacle

to movement in conditions of this sort could exist which the finger introduced in the manner I have mentioned would fail to detect, assuming, of course, that it is endowed with sensation of average acuteness.

In the large majority of cases neither pain nor effusion worthy of mention follows immediately upon the operation. In some, however, for reasons which are not apparent, the post-operative effusion is extreme, and the pain intense; and it is curious that pain of the most acute kind may occur without any perceptible effusion, being for the most part due to spasm or cramp in the leg and thigh, which nothing but gentle, smooth massage, or, less to be desired, a full hypodermic dose of morphine will relieve. Tension, when present from effusion, especially if the pain be great, should be relieved by passing a director through the lower end of the wound, and draining the fluid away, letting it subsequently, if it will, drain into the dressing. The skin sutures need not be disturbed. The most painful effusion comes on generally about the second or third day after the operation. If properly managed these apparently untoward complications do not affect the perfect result of a case, although they may delay the convalescence for a few days. The acutest pain I have ever seen follow within a few hours of operation was due to tension caused by hæmorrhage into the joint. The wound was opened up, the clots turned out, and a rapid recovery followed.

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There can, I think, be no doubt that the success of the operation depends more upon the management of the case before and after the treatment than upon any special method of operating. The patient should, if possible, be laid up for two or three days before the operation, daily massage without passive movement being used, and no thought of operation entertained until all fluid in the joint has disappeared. To operate in the presence of fluid in the joint is, I am sure, reckless. Upon the day following the operation, unless pain or other unforeseen conditions are contra-indicative, massage of the limb generally above and below the knee is commenced, the dressings of course, being left undisturbed. Gentle passive movement of the patella, in order to prevent it becoming in any way fixed—one of the most important points in the subsequent progress of the case—is commenced not later than on the fourth day, the outer dressings being, if necessary, removed daily for this purpose. At the end of a week passive or voluntary movement of the knee is generally commenced, and at the same period or a few days later in an uncomplicated case the patient may often be allowed to stand on the leg for a short time daily. To the constant use of skilled muscle massage I attach great importance for reasons already discussed in connection with flaccidity of the joint capsule, upon the presence or absence of which depends to a very large extent the failure

or success of the case. In connection with the progress of the cases after operation, when the semi-lunar cartilage itself is dealt with, an interesting point is afforded by the variability in the course of the cases during the first week, which in the majority is unattended by pain or discomfort of any kind, there being neither effusion nor other objectionable development. In an ordinary case the patient should be walking in a fortnight after the operation. As a contrast in methods of treatment it is interesting to read in one of the latest American works on surgery that after removal of a semi-lunar cartilage "fixation for two or three weeks should follow, after which massage and passive manipulation are begun."*

Condition of the semi-lunar cartilages as revealed by operation.—The injuries to the cartilages operated upon in my own practice may be arranged in seven groups, which will be, perhaps, best explained by the following diagrams, each of which shows the condition found in an operation, and forms the basis of a group in which are included all the cases presenting conditions identical with, or of the same type as, that depicted. It is noteworthy that when the external cartilage is at fault it is generally much more damaged (*i. e.* split, crushed or torn) than is the internal when it is the part concerned, as would be expected, seeing that in cases of detach-

* 'Keen's Surgery : Its Principles and Practice,' 1907.

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ment of the external the violence is often direct, and, as a rule, more severe than that causing lesion of the opposite cartilage.

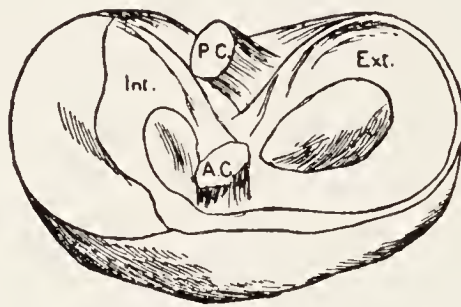


FIG. 7.—Semi-lunar cartilage lesion, type 1. Anterior two-thirds of cartilage displaced inwards; anterior extremity remaining attached; 48 per cent. of cases operated upon, only one case in ten involving the external cartilage.

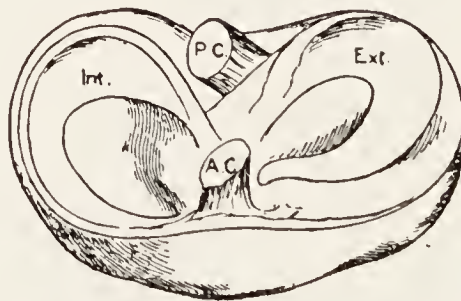
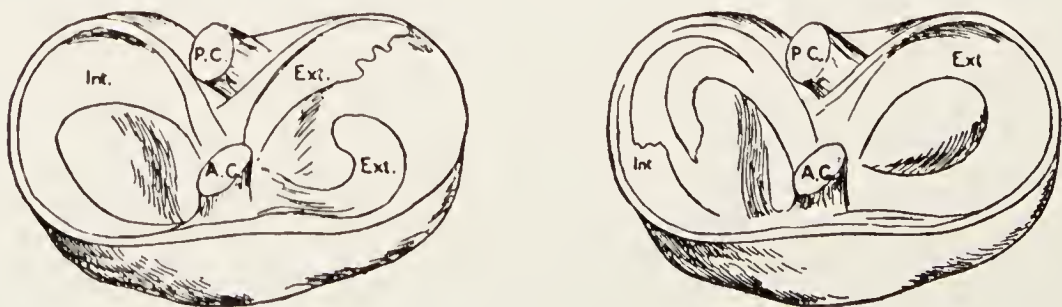


FIG. 8.—Semi-lunar lesion, type 2. Anterior half of cartilage displaced inwards, anterior end torn away from attachments; 30 per cent. of cases operated on; internal cartilage involved in the proportion of ten to one.



FIGS. 9 AND 10.—Semi-lunar lesion, type 3. Cartilage torn across near centre; posterior part of anterior segment displaced inwards in some cases, in the others the posterior segment was the displaced part; 15 per cent. of cases operated upon, the external cartilage being involved in the proportion of about two to one.

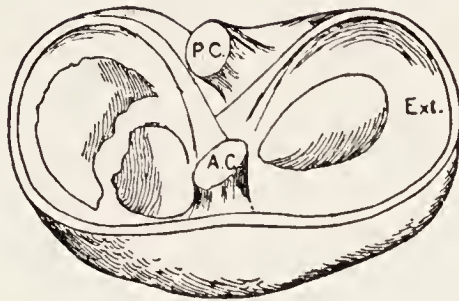


FIG. 11.—Semi-lunar lesion, type 4. Cartilage split longitudinally over middle two-fourths, remaining attached at both ends in some cases, in the remainder anterior segment split up to anterior attachment; 7 per cent. of cases operated upon; internal and external cartilages involved about equally.

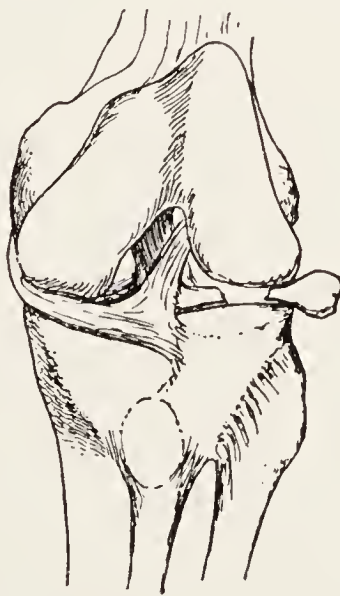
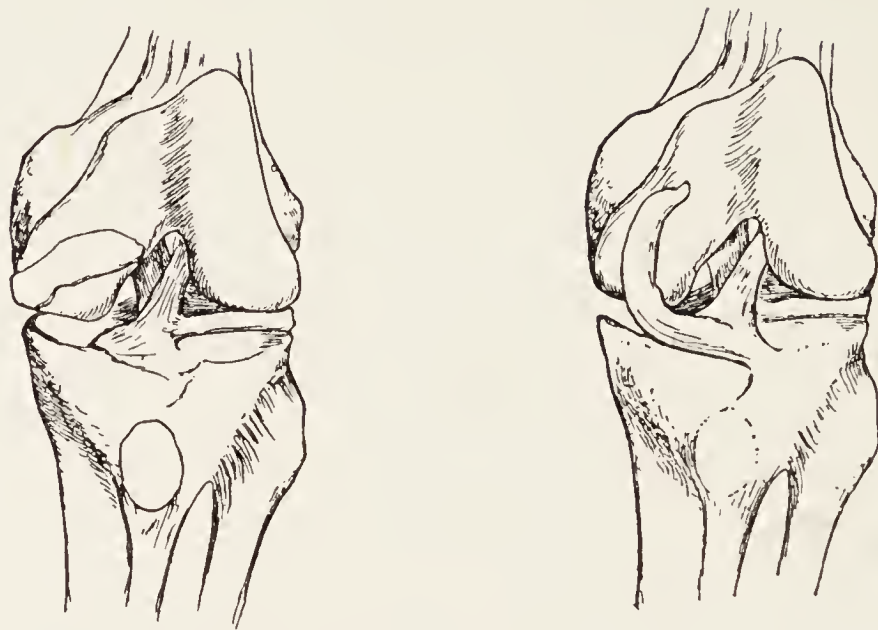


FIG. 12.—Semi-lunar lesion, type 5. Cartilage torn from connections anteriorly and pushed outwards, forming a tumour readily felt under the soft parts. Three cases only met with (one involving internal cartilage and two the external).

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FIGS. 13 AND 14.—Semi-lunar lesion, type 6. Cartilage torn from lateral connections and turned up on to articular surface of condyle. Two cases only seen, both involving internal cartilage.

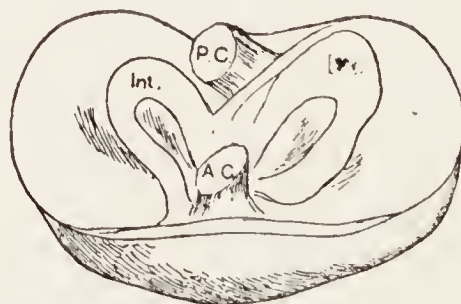


FIG. 15.—Semi-lunar lesion, type 7. Both cartilages torn from lateral connections and greatly displaced inwards. Two cases only seen.

CHAPTER X

LOOSE BODIES IN THE KNEE-JOINT

For my present purpose by these are understood masses of organised lymph or blood-clot, vegetations, or hypertrophied synovial folds, which, having become detached, lie loose in the articulation, and are consequently liable to insinuate themselves between the bone ends, or to become from time to time fixed in pouches or extensions of the synovial membrane, in such a way as to cause sudden acute pain, and in extreme cases collapse of the limb, leading the patient to fall heavily. In some cases they make their appearance under the capsule of the joint, where they can be felt, and the projection on the surface of the joint caused by their presence can sometimes be seen. Frequently very little pain arises from their wanderings, but the movement of the joint is almost invariably interfered with for the time being to some extent. It is often stated that the only cure for a "loose cartilage" is its removal by operation, and this is so, provided that by cure is meant the getting rid of the objectionable structure,

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but if a cure may be considered to be included in the mere relief of the symptoms, a spontaneous cure not uncommonly happens either by the loose body becoming fixed or isolated peripherally in some pouch or extension of the synovial membrane, generally above the patella, or in consequence of its dropping into the posterior part of the joint behind the crucial ligaments, where it may remain indefinitely without causing further trouble—an important point in relation to treatment for the following reason: These loose bodies are notoriously slippery and elusive in their habits; it is therefore not unusual to find that a body of this kind which has been clearly perceptible and perhaps apparently fixed immediately before an operation intended for its removal, has entirely disappeared by the time the patient has been anæsthetised. A very practical question then arises—Should the joint be opened up and explored on the chance of finding the vanished body at once, or should the operation be postponed until the loose body has become manifest again?

The exploration of the joint on the chance of finding the abnormal body must, if done at all, be very complete, and this may mean a very serious interference with the articulation, which after all may fail to reveal the body sought for, as has happened on more than one occasion.

Having regard, then, to the fact that these bodies sometimes, when they cannot be made manifest after

very free manipulation under an anæsthetic, give no further trouble, the following course seems to be dictated by prudence and common sense: If the loose body has been in the habit of appearing under the capsule at various points—for an example, first on one side of the joint and then on the other—it is certain that it is free and unfettered, and further operation should be deferred; on the other hand, if the body has always made its appearance at or about the same spot, the inference is either that it is not completely free (being, perhaps, for example, anchored by a long pedicle), or that it occupies a more or less distinct pouch of the synovial cavity which it does not leave, an operation for its removal may therefore be safely proceeded with, the incision into the joint being made over the situation at which it is in the habit of presenting itself.

In cases in which the appearance of the loose body is brought about only by a rotatory movement of the leg upon the thigh, especially when, as nearly always happens, the joint is very lax, an alternative to operation is the wearing of an apparatus similar to that referred to in describing the treatment of internal derangement (Fig. 4).

CHAPTER XI

MODIFICATIONS IN THE MOVEMENTS OF THE KNEE-JOINT DIRECTLY CONSE- QUENT UPON INJURY

THE remarks which follow are intended to apply only to cases in which modification of movement at the knee occurs, either immediately upon the receipt of injury, or supervenes after an interval without the complication of organic disease of the joint. The primary excessive mobility occasionally met with in complete dislocation and in extensive lacerations is outside my present purpose, and I am not now concerned with impairment of motion from paralysis following upon nerve injury.

I. MODIFICATION OF MOVEMENT FOLLOWING IMME- DIATELY UPON INJURY.

For clinical purposes this variety may be divided into two types: (*a*) That in which the joint is completely locked, no movement of any kind being

possible; and (b) that in which flexion to a limited degree, which differs in different cases, is possible, the restriction of movement in each case being due either to mechanical obstacle or to pain, as the case may be; in none of these cases is complete voluntary extension possible unless the limitation be due merely to effusion into the joint—a matter to which further reference will be made.

Cases in which complete locking of the joint occurs.

—(1) *From mechanical obstacle.*—The commonest cause of this condition, in which the leg is usually fixed at some point between extension and semi-flexion—generally nearer to extension than to the other position—is, in patients up to thirty or thirty-five years of age, displacement of one or both semi-lunar cartilages. After that age displacement of the semi-lunars becomes a less frequent cause, as it gives way to intrusion between the bone ends of hypertrophied synovial fringes, especially in osteo-arthritic subjects.

A certain number of cases may arise from anatomical peculiarity in the arrangement of the tissues behind the ligamentum patellæ, and in a few instances the trouble may be caused by an abnormal flap of synovial membrane, underlying and dependent from the patella. This last condition, which I do not remember having seen mentioned in surgical literature, is well illustrated by the following case:

CLINICAL EXAMPLE No. 21.—A man, aged twenty-three years, who had from time to time noticed a “catch” in the left knee whilst walking, slipped when running and found the knee completely locked in a slightly bent position; in the course of hobbling home the knee suddenly became free. Similar happenings repeated themselves, and I finally saw him with the knee locked. An operation being obviously indicated, I opened the knee and found the cause of the trouble to be an apron-like flap of synovial membrane, quite normal excepting at its free end, which had been squeezed between the bones. Removal of this flap, of course, entirely cured the symptoms. The structure removed was clearly a mere abnormality and not a pathological product.

I have since noticed in other knee-joints a similar but smaller flap springing from the same situation. In only one case have I seen the knee locked in a position of flexion, the calf of the leg being almost in contact with the thigh. This occurred in a man fifty years of age or thereabouts, the subject of osteo-arthritis, who fell downstairs and found the limb fixed in the position indicated; no manipulation, with or without anæsthetics, availed, and upon opening the joint an irregular loose body, as large as an ordinary marble, was found wedged in between the tibia and femur, just in front of the point of crossing of the crucial ligaments. The

remaining causes are, for the most part, completely loose bodies ("loose cartilages") or bodies attached by long pedicles.

Other causes are met with, such, for example, as a piece of bone broken off from one of the condyles of the femur acting as a wedge between the bone ends, an example of which was at one time in the museum of St. George's Hospital. Conditions of this kind are, however, so rare as to be of little importance, excepting that they emphasise the value of the use of the X-rays in the diagnosis of these cases. The causes already mentioned are all intra-articular, and produce mechanical obstacles to movement which may or may not produce great pain.

Fixation of the joint as a consequence of displacement of the tendon of the popliteus muscles is, I believe, sometimes thought to occur, and in two cases at least such a cause has been given by surgeons of repute in cases which have afterwards come under my observation. Although the diagnosis naturally excites admiration, I am compelled to confess that I have never been able to arrive at it myself, nor have I met with anything in the course of operations upon the knee or in the dissected subject which would lead to the conclusion that displacement of the popliteus tendon without displacement of the external semi-lunar cartilage could provide a mechanical obstacle sufficient to lock the knee.

Locking of the knee-joint, which may in the ab-

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sence of anæsthesia be apparently complete, sometimes arises from conditions outside the joint, the fixation being due to muscular spasm secondary to pain. The most striking of these which I have seen, the diagnosis having been corroborated by the X rays, were oblique fracture of the head of the tibia, fracture of the fibula immediately below the head, and spontaneous detachment of a pedunculated osteoma from the femur, just above the inner condyle. The case of fracture of the fibula below the head is worth a brief notice.

CLINICAL EXAMPLE No. 22.—The patient was a man aged twenty-eight years, who, in slipping off the kerb, felt an acute pain on the outer side of the knee, which at once became slightly flexed and could not be moved. I saw him within a few hours of the accident. The knee was somewhat bent, and any attempt at movement in the joint was impossible on account of the pain. There was marked tenderness on pressing along the line of the joint just above the head of the tibia, such as is often present in displacement of the external semi-lunar. No crepitus could be felt, but an X-ray examination readily detected the lesion.

With regard to the treatment of these locked cases, it is essential that means should at once be taken to make the diagnosis sure and to rectify the defect. There is no excuse whatever for delay, whether there is great swelling or not. An anæ-

thetic should be administered as soon as possible ; if, when the patient is fully under its influence, the limb drops spontaneously into the extended position, the question of a foreign tissue between the bone ends may be set aside, but if the knee remains bent, no matter how slightly, there is almost certainly something out of place, which must be replaced by manipulation, if possible. This remark applies only to cases dealt with very soon after the injury ; when replacement has not been effected until some days later, temporary slight flexion of the knee may remain after reduction in consequence of swelling about the parts concerned.

It should be noted that the main part of the limitation of movement in these cases is due to muscular spasm, the amount actually caused by the structure wedged between the bones being often comparatively small. Profound anæsthesia removes the spasm of the muscles and reveals the real amount of limitation produced by the mechanical obstacle. This limitation is at times so little that an inexperienced person may easily be led to think that the obstacle no longer exists, because the limb, unless compared very carefully with that on the opposite side, may seem to be straight. This very careful comparison of the two limbs under the circumstances is especially called for, because extension in its extremest degree is not naturally possible in some subjects, the knees in such persons seeming to be a little bent even when

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the limb is straightened to the fullest extent, so far as they are concerned (*vide* Chapter I).

It would seem needless to insist on immediate action in cases of this kind, but it still remains a fact that even in these days there is a tendency with some people to postpone attempts to rectify defects of this kind for insufficient reasons. Whenever available the X rays should, of course, be used, and not set aside because it may seem unlikely that they will give any information. Although the spontaneous straightening of the limb to its normal extent under the anæsthetic shows that nothing is wedged between the bones, it by no means proves that the fixation previously existing was not due to impaction of a loose body, because these bodies are notoriously elusive, and are very liable to slip back into the joint as the patient becomes unconscious.

Cases in which restriction of movement follows immediately upon injury without complete locking of the joint.—In certain cases in which a foreign body becomes wedged between the bone ends, some amount of movement is possible if the intruded tissue is very small, or so situated that it exercises its wedge-like influence in certain positions only ; but, as a rule, cases in which the limitation of movement is only partial are caused by conditions outside the joint, or, if intra-articular, are unconnected with structures intruded between the bone-ends, such, for example, as may occur when a semi-lunar cartilage

is so completely loosened as to lie in the intercondyloid notch—a not altogether rare condition. The commonest, perhaps, of all intra-articular changes, although it is one which has not received much attention, in cases of this kind is, I believe, laceration of one or both crucial ligaments. It is noteworthy that in nearly all the cases in which defective movement of the kind we are considering follows upon injury, after an interval, the main difficulty is in flexion, and not in extension, as happens when locking at first has been complete. The injury leading to lesion of the crucial ligaments is generally a violent forcing backwards at the knee-joint. In a case of this kind, in which gangrene followed on account of damage to the popliteal vessels, the anterior crucial ligament was torn three parts across. Injury to these ligaments as a cause of defective movement in the knee is probably commoner than is usually supposed. I shall refer to a notable instance presently.

Beyond the causes already mentioned, the most common are extra-articular, such as laceration of muscle close to the joint, the inner head of the gastrocnemius being, perhaps, the commonest part affected; thrombosis from injury to a vein; the formation or rapid increase of a popliteal bursa in osteo-arthritic subjects with effusion in the knee-joint, in connection with which a suggestive clinical fact sometimes occurs, which is best illustrated by a case.

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CLINICAL EXAMPLE No. 23.—A patient, aged fifty-three years, who had long suffered from osteo-arthritis, with effusion in both knees, which were continually painful, whilst under my observation fell heavily with the right knee bent under him. Acute pain followed, and when I saw him an hour or two later he was able to bend the knee only very slightly without intense pain. There was no increase of effusion, and extension to the full degree was easy. The popliteal space was full and tender. In the course of a few days the general fulness in the popliteal space had gone, leaving a well-defined bursa easily detectable, which had not, I know, been previously perceptible. By degrees flexion became painless, but never so complete as before the injury ; the acute pain, however, from which the patient had continually suffered before entirely disappeared.

The case affords an excellent illustration of the way in which the formation of a bursa in connection with an osteo-arthritic condition with effusion will, by relieving tension in the articulation, remove pain which has resisted all attempts at cure—a fact which, although familiar to those who are much concerned in treating joints of this type, is not often so well demonstrated by injury. The diagnosis of these cases raises one or two practical points. Speaking generally, it will be found that in intra-articular lesions following injury in which defective movement immediately ensues, whether

it be complete locking or mere limitation, if the main difficulty is in extension there is a mechanical obstacle of some kind between the bone ends or wedged somewhere in the joint. Exceptions to this occur rarely in the event of loose bodies being caught in the supra-patellar pouch. If extension is free, the question of foreign bodies between the bones may be for practical purposes set aside. In relation to pain upon flexion after injury the effect of effusion into the joint is of moment. In the majority of cases like those which we are discussing, acute effusion occurs in a greater or less degree, and acute effusion, unless very trivial, always presents an obstacle to flexion, but not to extension, unless great tension from an excessive amount of fluid exists. In determining whether pain on flexion under these circumstances is due merely to effusion or to some form of damage to the joint mechanism, the principal means of diagnosis lies with the distribution of the pain. If the obstacle to flexion be due to effusion only the pain will be most intense across the joint at about the level of, or a little above the upper end of the patella, being caused, in fact, by the tension in the supra-patellar pouch. If, on the other hand, it be due to intra-articular damage, it will be felt most acutely along the lateral line of the joint, across the ligamentum patellæ or deep in the popliteal space; but loose bodies in the patellar pouch, such as are sometimes met with in osteo-arthritis, may produce

pain during flexion like that caused by effusion, and for the same reason. The decision as to whether the defect is due to extra-articular damage or not must depend largely upon the evidence of injury to the soft parts, as shown by swelling, bruising, tenderness, and so forth.

II. MODIFICATION OF MOVEMENT FOLLOWING UPON INJURY AFTER AN INTERVAL.

In this type of case the interval between the receipt of injury and interference with movement may vary from an hour or two, or even less, to weeks, or perhaps months. In the former case the defect may as a rule be regarded as temporary, and readily curable; in the latter the defect is generally permanent, unless remedied by some radical measures. When the oncoming is quick difficulty is generally felt in extension, flexion being comfortable and easy. In the defect which supervenes after a long interval, with the exception of cases in which improper splinting has led to adhesions, or in which laceration of the crucial ligaments has occurred, the cause is usually extra-articular, and often quite remote from the joint, flexion as a rule being the restricted movement. In the cases in which the symptoms follow soon after injury the interval may be so short as to be misleading, unless the history of the patient

is carefully weighed. As an example of this, the following case will serve :

CLINICAL EXAMPLE No. 24.—A man, aged thirty-eight years, who from time to time had for several years suffered from slight pain in the right knee after much exercise, noticed some discomfort in the joint after playing a couple of rounds of golf. He walked home, a distance of a mile and a half, with some inconvenience and increasing stiffness. He sat down to dinner with a slightly painful knee, and found, on attempting to rise from his chair later on, that the leg was fixed in a bent position, and could not be straightened on account of the pain. He consulted me a few days later. On examination the leg was bent in a position midway between extension and semi-flexion. At the inner side of the knee, in connection with the hamstring tendons, was an extremely tense bursa, which, upon any attempt at extension, became intensely painful ; flexion was easy and comfortable. This was clearly a case of gradual strain of the knee, resulting in the distension of a pre-existing bursa. An interesting and deceptive symptom in the case was a painful and tender area over the external semi-lunar cartilage, which, had the history been misinterpreted, might easily have led to an impression that the cartilage was displaced.

In all cases of limitation of movement, especially if it be in flexion, supervening at any considerable

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interval after injury, the liability of the defect being due to lesions remote from the joint is a very important consideration; indeed, in any case of the kind it is essential that a careful examination of the whole limb should be made before a definite line of treatment is decided upon. The following case is an excellent object lesson in this respect :

CLINICAL EXAMPLE No. 25.—A man, aged twenty-six years, fell across a plank, striking his thigh and damaging the knee. Some swelling of the joint followed, which, under treatment, subsided, and for a time he got about his usual business. A few weeks afterwards, however, he began to feel some pain about the knee and thigh when the leg was acutely flexed, and by degrees he found the bending of the leg more and more difficult, until flexion beyond a right angle became impossible. At this stage the defect caused very little inconvenience in a general way, but after walking more than a mile or two the limb felt heavy and weary, some aching being at the same time felt in the thigh. He therefore consulted a bone-setter, who proposed to break down the “adhesion” by forcible flexion, but fortunately before submitting to this treatment he sought further advice, although he said he had already been told by a medical man that if there were adhesions he did not think they gave enough trouble to justify their being broken down. Upon examination I found the

following condition: The patient was a healthy-looking subject, who walked well, and without any suggestion of lameness. Flexion of the leg upon the thigh was abruptly checked at a right angle; there was no pain, and the movements of the joint were perfectly smooth and natural up to the point of locking. Upon examining the thigh its middle third was rather full and very hard, altogether unlike the opposite side. On seizing the quadriceps muscle at this spot it seemed for the most part to consist of a solid mass. I came to the conclusion that the injury to the thigh had led to myositis ossificans of the quadriceps, which accounted for the abrupt arrest of flexion of the leg at a right angle, as I had seen happen in other cases. An X-ray photograph, by Mr. Mackenzie Davidson, corroborated the diagnosis.

Had the breaking-down treatment been adopted, and the leg violently flexed upon the thigh, one of two things would have happened, namely, rupture of the quadriceps just above the knee, or fracture of the patella. I was present at a case of a similar kind in which the latter accident occurred. Should no cause remote from the joint be detected, some intra-articular condition must be considered. There is little doubt that the most inveterate of intra-articular causes of limitation of movement of the kind under consideration is laceration of the crucial ligaments. A few years ago a case of this kind afforded me one of the few opportunities which have

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in my experience justified a transpatellar investigation of the knee-joint after injury.

CLINICAL EXAMPLE No. 26.—The patient was a robust man, whose knee when flexed came to a deadlock at a right angle ; there was no pain or other trouble, but, for reasons sufficient for the patient, it was thought absolutely necessary that an attempt should be made to obtain a freely movable joint at any cost. A transpatellar examination was therefore made. Nothing abnormal was found beyond complete matting together of the crucial ligaments, which had evidently been badly torn in an accident three years previously. An attempt was made by splitting the matted tissues to reproduce something approaching a normal arrangement, but it could hardly be described as successful so far as the ultimate result was concerned ; the patient was, in fact, neither better nor worse for the operation.

In the investigation of cases in which complete extension at the knee-joint is apparently impossible some time after a severe injury it should not be overlooked that the defect may be due, not to any lesion in the knee itself, but to the union in a faulty position of a fracture in its immediate neighbourhood, a condition well shown in Plate V, to which I shall refer again. The most deceptive condition of all in this respect, the mechanism being precisely the same as that seen there, occurs occasionally in young subjects in consequence of overgrowth of the

anterior segment of the lower epiphysis of the femur, leading to a slight turning backwards of the articular surface of the condyles, which leaves the leg a little bent upon the thigh, although the knee-joint may be fully extended. This condition of the epiphysis seems to be produced by some trivial injury. The cases which I have seen have been in patients about twelve years old, who had been suffering a good deal from "growing pains" in the affected limb. I have in my possession an excellent X-ray photograph of one of the cases, by Mr. Mackenzie Davidson.

ABNORMAL MOBILITY IN THE KNEE-JOINT AFTER INJURY.

In a certain number of cases of severe injury in the region of the knee-joint excessive mobility, apparent or real, is found either upon removal of splints or other retaining apparatus, or slowly develops in course of time.

In cases where there has been extensive laceration of the capsule or ligaments, notably the posterior, the development of such abnormal mobility should excite no surprise. The unnatural lateral movement associated with almost all displacements of the semi-lunar cartilages, increasing in degree with each recurrence, has been already referred to. In a number of cases of this kind, however, the cause of the apparent abnormality lies altogether outside

the joint, and it is to these, the most interesting of all, to which I wish to call attention here, as they have, so far as I know, received too little attention. It more often happens, I think, than is commonly thought, that after fracture of the lower end of the femur there is a certain amount of over-extension "in the knee"—that is to say, in extreme extension of the lower limb, the leg, instead of forming a straight line with the thigh, inclines forward at an angle which varies in degree in different cases; sometimes to an extent hardly noticeable, at others to a degree which is not only noticeable, but which completely cripples the patient. The position assumed by the leg in the slighter cases of deformity is sometimes attributed to elongation or relaxation of the posterior ligament, etc., whilst the extreme cases lead to a condition which might, upon superficial or careless examination, suggest exaggerated genu recurvatum.

As a matter of fact, the knee-joint in these cases is of course not involved at all, the abnormal position being due to the lower femoral fragment having united in a faulty or vicious way. The following is a typical, although exaggerated, example.

CLINICAL EXAMPLE No. 27.—A man, æt. 28 years, sustained a compound fracture of the lower end of the femur from gun-shot wound. Firm bony union followed in due course. When he commenced to walk about he found that the knee was inclined to

“bend backwards” at first, whilst the limb was still stiff, only slightly, but to such an extent when the joint had become supple that it would, unless he was very careful, suddenly “give” in a backward direction and bring him to the ground. With great care, whilst his attention was concentrated on the limb, he could walk fairly well in a rather stilted fashion, but if his attention was withdrawn, back would go “the knee,” with the result described. The condition being an impossible one for active purposes, he was sent to me for advice. It was at once obvious that the knee-joint was quite natural in all respects, and that the defect complained of was due to the lower fragment of the femur having united at an angle that caused the condyles to point forwards, with the result that when the knee was fully extended the leg was bent forward, as if in a position of hyper-extension. When walking, so long as the patient kept the knee-joint sufficiently flexed to correct the faulty axis of the lower fragment he got along pretty well, but the moment he was off his guard the leg became automatically extended at the knee, and down to the ground he came.

The treatment offered only two alternatives—the rectification by operation of the faulty position of the lower fragment of the femur, or the use of an instrument so constructed as to prevent complete extension of the leg at the knee. The latter course was chosen.

Plate IV is an X-ray photograph of the case, which will explain itself, and should be contrasted with Plate V, fig. 2, which shows exactly the reverse condition, the lower fragment having united with the condyles pointing backwards, in such a way that when the leg was fully extended at the knee it was still bent upon the thigh. I quote this case particularly in some detail, not because it would be likely to deceive any but a very careless or inexperienced person, but because it demonstrates so well a condition which, if it occurred in a very slight degree, might readily be misinterpreted, unless the importance were realised of bearing in mind the fact that apparent abnormal movement in the knee-joint may be due to causes outside the articulation. It also shows the supreme importance of the use of the X rays in all of these cases.



Faulty union after fracture of the femur leading to apparent modification of movement in the knee-joint. The arrow indicates the position assumed by the tibia in complete extension at the knee when, although normal in its relation to the condyles, it projects forwards, in consequence of the altered axis of the lower fragment, in such a way that it suggests genu-recurvatum. For comparison see Plate V.

CHAPTER XII

STIFFNESS AT THE KNEE-JOINT

For the purposes of the present discussion stiffness of the knee-joint is intended to mean any condition after injury or disease, in which the patient is unable to fully flex or extend the leg upon the thigh. The position of fixation or restriction is immaterial and may be at any angle between complete extension and flexion. The cases I propose to consider are only those in which the stiffness, or inability to bend or extend the joint, remains after the treatment of the original injury or disease has been completed—spastic contraction from central nervous disease and rigidity from contraction of scars of burns being excluded.

The causes of this condition in the knee are, of course, the same as in other joints, and may be classified as follows :

(1) Intra-articular : Extensive fibrous adhesions ; adhesion between the bone ends ; matting of crucial

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ligaments ; partial displacement, *e. g.* in tuberculosis ; wedging of displaced or hypertrophied structures between the bones, and bony ankylosis.

(2) Peri-articular : Matting of capsule ; adherent tendons ; displaced tendon ; implication of nerve (*e. g.* external popliteal) in scar tissue.

(3) Remote from joint : Adhesions of muscles around a fracture ; traumatic myositis ossificans ; contracted muscles, mainly hamstring tendons from reflex causes or from persistent immobilisation.

(4) Anomalous causes : For example, pain, interlocking of osteophytic masses, or prevention of motion in the joint by change in shape of bony surfaces in osteo-arthritis.

When the stiffness is only partial the first essential is to ascertain whether it is due to organic changes in the articulation, or the parts around, or whether it is caused by reflex muscular contraction or some other temporary defect. Obvious changes in the joint or surrounding tissues may be sufficient to establish a diagnosis without difficulty, but in many cases an accurate result is only obtained by the aid of an anæsthetic, which, in any case of doubt, should, of course, be employed.

It is impossible to emphasise too much the deceptive nature of stiffness of the joint which is sometimes met with, and it is of importance to avoid being influenced by a patient's estimate of his own case. The following, which is the most perfect

example of pseudo-ankylosis with which I have met, will show what I mean :

CLINICAL EXAMPLE No. 28.—A very healthy, robust man, aged thirty-four years, sustained abroad an injury to his knee, the nature of which was doubtful. The limb was placed in a plaster-of-Paris splint for six months, at the end of which, the plaster mould having been removed, an X-ray photograph was taken, and (it was said) showed complete ankylosis, so he was informed that a stiff limb for life was inevitable. He was encouraged to walk as much as possible, the knee being, of course, stiff, and massage of the muscles, without any attempt at bending the limb, was used for some time. When I saw him, fifteen months after the injury, he was walking with a rigid limb, the muscles were wasted, and to ordinary manipulation the limb was perfectly stiff. An X-ray exposure showed at that time no evidence of intra-articular change. An anæsthetic was subsequently administered, and the limb, whilst the patient was passing under its influence, bent spontaneously enough to show that ankylosis did not exist. Very moderate force was sufficient to fully flex the limb so that the heel almost touched the buttock—in other words the joint was entirely normal, and the apparent ankylosis was due to unnecessary immobilisation, combined with the effect upon the patient of the opinion given that the limb would be stiff for life. Within a fortnight of the

flexion of the limb the patient was walking with a natural gait, although the limb was weak from wasting of the muscles. This is the kind of case which contributes to the success of the unqualified practitioner, the so-called "bloodless surgeon."

Remote causes of restriction of movement having been eliminated, the next point to determine is whether, having regard to the amount of disability, any further treatment is desirable or necessary, and if it is, whether the radical method of forcible bending should be adopted or not. Speaking generally, it may be said, bony lesion or displacement having been put out of court by the use of the X rays, that the radical method is practicable with safety in ordinarily discreet hands. The joint, at all events, should be examined under a general anæsthetic, and the treatment proceeded with according to the evidence thus afforded.

It should be an unalterable rule that no final opinion is given in a case of stiff knee until an examination under an anæsthetic has been made, since, as the case quoted shows, the simulation of stiffness from organic causes may be so perfect (apart from neuro-mimesis) that nothing short of an anæsthetic permits a diagnosis.

When the stiffness is complete and real, *i. e.* the result of organic change, the primary point is to determine whether the stiffness is due to bony ankylosis or not. In a general way bony ankylosis may

readily be revealed by an effective X-ray photograph taken stereoscopically. The single X-ray negative is apt to be deceptive unless the rays are very carefully directed. I have, for example, seen a joint, in which the ordinary X-ray shadowgraph indicated bony ankylosis, bend up under an anæsthetic without difficulty.

Method of examination.—In the examination of a knee-joint, in order to determine the degree of stiffness present the following practical details are of the first importance.

The main difference felt upon manipulating a joint which is in a condition of bony ankylosis and one which is merely stiff from adhesions or matting is, of course, that the former is absolutely rigid in its stiffness, whilst the latter gives a sensation of “spring” in the line of the joint on attempts at bending. In some cases the signs of the two conditions of true ankylosis and extreme rigidity from adhesions approach so nearly to one another that it is only by the most careful manipulation that they can be differentiated. It is by attempts at forcible flexion alone that a reliable judgment in this respect can be arrived at, the evidence of attempts at extension being nugatory and deceptive. In testing the rigidity of a joint by flexion the following points are essential to be observed in different cases: (1) The proximal bone must lie along its whole length upon a flat surface

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(*e. g.* a kitchen table), to which it can be firmly applied by pressure of the hands of an assistant or some other means. (2) The end of the flat surface must lie exactly across the middle of the articulation, so that when pressure is made upon the leg the stress of strain comes accurately upon the line of the joint. (3) The pressure upon the leg should be such as is likely to elicit the sense of "spring" in the articulation most correctly; to this end the leg should not be grasped in the hand and forcibly bent continuously, but the hand of the manipulator should merely be laid upon it, and a decided but not too sudden impact given. A sense of spring in the line of the joint will in this way be much more easily determined than by the firm grasp and forcible attempts at flexion usually employed, since the forcible attempts referred to are liable to convey a sense of spring which involves, not the joint alone, but the whole of the bony apparatus of the limb.

By the above method it is almost impossible to be deceived as to the nature of the stiffness, even in the most difficult cases. In an ordinary way the following plan will suffice. One hand of the manipulator should be placed on the flexor side of the knee, the limb being poised upon the hand thus placed; the opposite hand taking the leg below its middle, attempts are made to flex the knee, whilst upward pressure is made by the hand which underlies the joint. Any material spring that there may be in the

articulation will be felt immediately, not by the hand which is on the leg, but by that which is beneath the joint. By such a method of examination a very slight amount of spring in an articulation can be appreciated by any person possessing an average acuteness of sensation, and in the case of a stiff joint in which there is a sufficient amount of spring to be appreciated in this way there is a strong chance, provided that the other conditions to which I shall refer presently are favourable, of a cure being effected by discreet forcible manipulations.

It is stated that a valuable indication of the existence of bony ankylosis on the one hand and mere stiffness on the other is the absence or presence of pain after violent manipulation under an anæsthetic, the subsequent occurrence of pain in the line of the articulation being held to be in favour of the absence of bony ankylosis. No reliance can be placed on this test, as in certain cases of bony ankylosis following upon tubercle manipulations are frequently followed by pain of variable severity. Of course, the proper appreciation of minute differences in rigidity must to a great extent be dependent upon the delicacy of the sense of touch in the manipulator, but, in a general way, the distinction is not difficult.

Points for consideration in deciding upon the propriety of "breaking down" a stiff joint.—Having determined that the joint is in a condition in which the question of "breaking down" may be legiti-

mately considered—in other words, that the joint is not in a condition of bony ankylosis—the next point to be decided is whether the breaking down is practicable on the one hand and desirable on the other. With regard to practicability, it may be at once conceded that any joint which has become stiff from any other condition than that of bony ankylosis can, as a rule, be broken down if sufficient force is used, provided that the anatomical relations of the parts are normal ; but sometimes the strength of the adhesions is greater than the strength of the bone, in which case a fracture in or near the joint may occur instead of a breaking down of the adhesions (Plate V, figs. 1 and 2).

In deciding upon the desirability of the breaking down of the joint the following points require primary consideration : (1) The history of the case ; (2) the condition of the articulation ; (3) the state of the soft parts around the joint ; (4) the condition of the muscles acting on the joint ; and (5) the condition of the bones.

(1) *The history of the case.*—This is important in relation to the causes of the stiffness. Speaking generally, cases in which the history points to tubercle, to inflammation during malaria, to disorganisation following upon enteric fever, and to the exanthemata, may be regarded as unfavourable for breaking down ; cases, on the other hand, in which the history points to injury, rheumatism,

PLATE V.

FIG. 1.

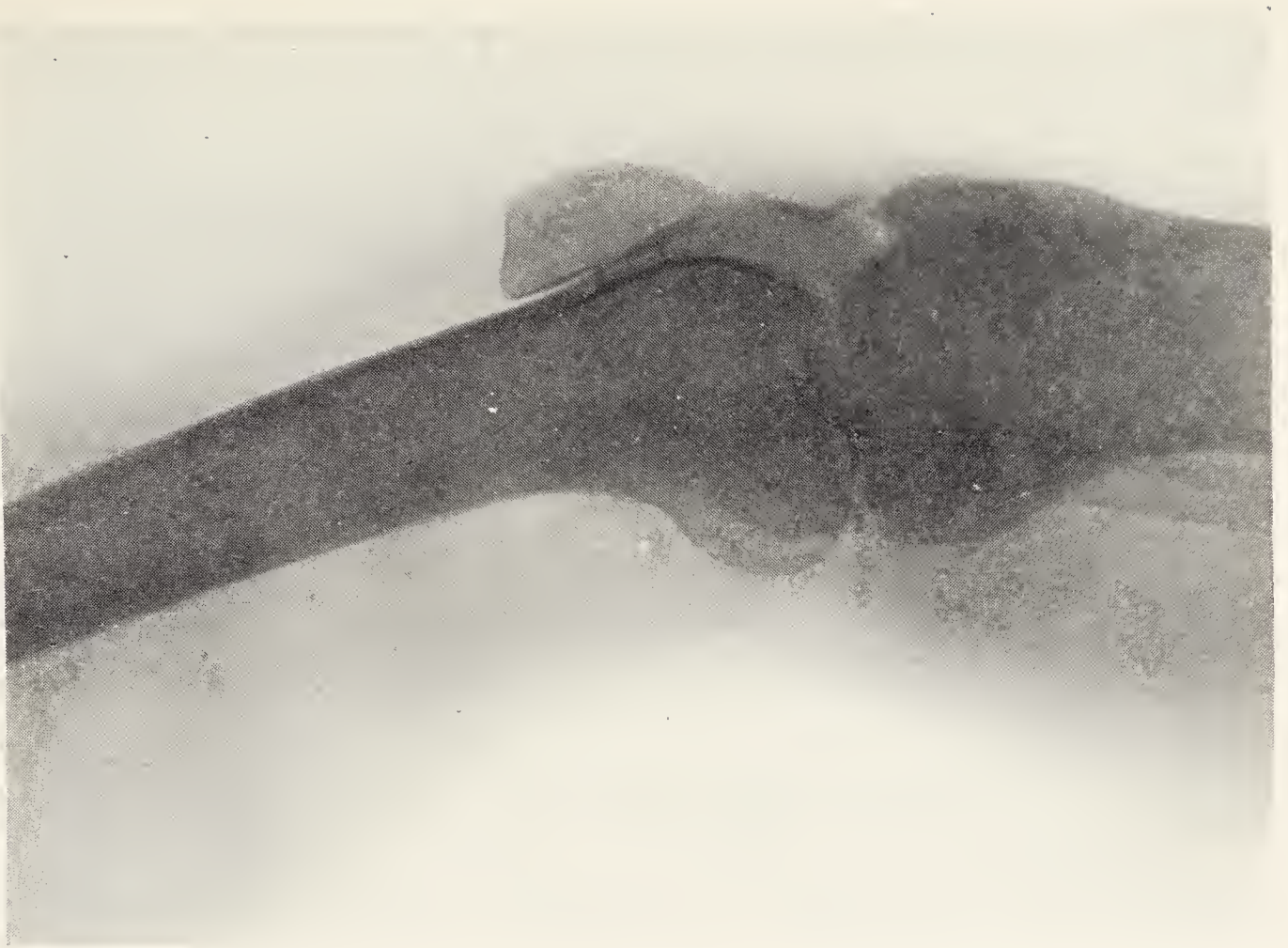


FIG. 2.



An ankylosed knee before and after ill-advised forcible bending. The resulting fracture has united in a faulty position, so that the condyles are directed backwards, the result being that, although the knee may be fully extended, the leg remains to some degree flexed upon the thigh. The opposite condition is seen in Plate IV.

pyæmia, osteo-arthritis, gonorrhœa, syphilis, and to various nondescript types of arthritis may be regarded as favourable for the treatment, subject, of course, to the qualifications dictated by local conditions which will be dealt with presently.

(2) *The condition of the articulation.*—The point of first importance here is that the relation of the articular surfaces should be normal, that there should, in fact, be no displacement, partial or otherwise. In the case of the knee the condition of the patella is of much moment, since, if it be fixed, the bone may be fractured during the bending of the joint—an accident which I have witnessed more than once; if the patella is freely movable it is practically safe from injury during forcible flexion of the knee unless the quadriceps is inelastic (*e. g.* in traumatic myositis ossificans).

Apart from the conditions just mentioned the joint may be of normal temperature to the touch, or it may be hot; further, it may contain fluid in excess or it may not. A heated joint, without fluid, is the least favourable for radical measures, since such a joint usually contains a limited tuberculous focus, which, upon the breaking down of the joint, tends to become acute and diffuse. Moderate heat, with effusion, is no bar to radical measures—indeed, it is at times a strong indication for their adoption, as the effusion and heat are often due to the dragging of adhesions, which, if broken through,

cease to trouble. All other things being equal, the less the rigidity of a joint the more favourable it is for treatment by immediate forcible flexion, provided that the defect is inside the articulation. In some cases, when the defect is extra-articular, it is otherwise.

The state of the soft parts around the joint.—Scars, sinuses, and matting of the soft parts about the joint do not as a rule contra-indicate forcible bending, if these conditions are confined to the extensor aspect and if no nerve is involved in the cicatrices. Should the parts be reduced merely to a thin, ill-nourished scar area, of course the risk of splitting this tissue must be borne in mind. Contracted scars and shortened normal tissues on the flexor side, if the joint has been for a long time bent, are very important, and if the flexion is extreme the propriety of extending the joint forcibly must be carefully weighed. As a rule in such cases immediate forcible extension is contra-indicated, gradual extension by the aid of massage and gentle passive movements or even by instrumental means being preferable in consequence of the tendency of the contracted skin and subcutaneous tissues to split transversely during violent extension.

CLINICAL EXAMPLE No. 29.—I well remember a remarkable case of this kind occurring in the theatre of St. George's Hospital. A patient, whose knee had been flexed for some years, was placed under an

anæsthetic for purposes of examination, as the defective joint for sufficient reasons had either to be straightened or removed. A somewhat forcible attempt to extend the limb was followed by considerable success, but the soft parts across the middle of the popliteal space split transversely, leaving the main vessels and nerves extensively exposed. Amputation was immediately performed. This case is an extreme one, but it illustrates the point under discussion.

In fact it is true generally that forcible flexion of a stiff knee-joint is not only more successful than forcible extension, but is comparatively devoid of risk if intelligently practised. The most difficult cases of all to deal with in my experience are those in which a nerve is involved in a cicatrix outside the joint. The pain in some of these cases makes anything like forcible bending quite impossible unless the nerve can be freed from the cicatrix in which it is involved—a measure which is sometimes impossible without producing paralysis, if it does not already exist, or increasing it if already present.

CLINICAL EXAMPLE No. 30.—A case in point which occurred in my own experience was that of a partially stiff knee from gun-shot wound, which, so far as the joint itself was concerned, was quite amenable to treatment; but, in consequence of some sloughing which had occurred, the external popliteal nerve was so densely implicated in scar tissue that

any material movement excited intolerable pain and temporary paresis. A case like this may be practically outside the limits of active surgical treatment, in the direction of obtaining a freely movable articulation, as the nerve cannot always be freed from its scar tissue without suffering considerable damage, but the remaining alternative, excision of the joint, with a view to obtaining a stiff and strong painless limb, may be worthy of consideration.

This again is an extreme case, but it is none the less instructive, particularly as advice was sought solely on account of the stiff joint, the importance of the nerve complication not having been recognised. It is well to bear in mind in cases of stiff joint that some of the greatest pain during the radical treatment may arise from conditions apart from the joint itself.

(4) *The condition of the muscles acting on the joint.*—The muscles in a case of stiff knee, especially the quadriceps, are naturally wasted more or less. The wasting may be slight or extreme, and in the latter case the muscles of the thigh may be reduced to a condition which is little better than that of fibrous cords. The wasting, whether slight or excessive, affects the proximal muscles mainly, *i. e.* the muscles which act directly on the joint under ordinary circumstances.

Speaking generally, the less the amount of mobility in the joint the greater is the wasting of the muscles,

for obvious reasons. The wasting, however, is not always the same in similar cases, although these may be in all other respects apparently the same. From the point of view of the radical treatment by forcible bending, muscle waste in itself is not of great importance, but rigidity of the muscles in addition to wasting is of considerable consequence. Muscular rigidity in these cases arises mainly from two causes: first, physiological shortening from the effects of disease or persistent complete disuse; and secondly, adhesion of muscles or muscle to the underlying bones from inflammation or injury, as examples of which may be mentioned the adhesions resulting from cellulitis or periostitis and the matting of the parts about a fracture; and thirdly, traumatic myositis ossificans. The more rigid the muscle the greater must be the care exercised in the forcible bending in these cases. It is, therefore, important to determine as far as possible to what extent, if any, the stiffness of the joint is due to the rigidity of the muscles. Speaking generally, it will be found that the greater the rigidity of the muscles the less favourable are the cases for the radical treatment. Although muscular rigidity in itself is no actual bar to attempts at breaking down, these, when rigidity is present, should be made with great care, as not only may a rupture of muscle occur, but what is worse, a bone may give way. The explanation of the danger of the latter calamity lies in the fact that when a joint has been

for a long period quite stiff and the muscles extremely wasted, the bone is always to some extent atrophied—a very important point in connection with the present discussion, and one which I do not think is sufficiently recognised. In fact, the condition of the muscles is a fair indication of the state of the bone in the matter of strength ; wasted rigid muscles indicate a weak bone, and *vice versâ*.

(5) *The condition of the bones.*—Beyond what has been already said there is little to be added under this head. Any obvious indication of bone weakness, such, for example, as loss of substance, may in some cases altogether negative the propriety of breaking down a stiff joint, and in all cases should lead to great care in manipulation. On the other hand, it is well not to assume, because a bone, as sometimes happens, is thicker than usual from some pathological change, *e. g.* osteitis, that it is abnormally strong. Although, as a rule, bones so affected are stronger over the actual area of the thickening, they are not always so immediately beyond, and I remember seeing a fracture of the femur in a middle-aged man which occurred during the breaking down of a knee-joint, the fracture occurring at the extreme upper limit of a considerable thickening of the lower end of the femur from old-standing osteitis. In this connection the tendency of a new growth to simulate simple bony thickening must not be lost sight of (Plate VI).



A case in which painless thickening of the femur above the knee was attributed to tuberculous disease until the occurrence of spontaneous fracture led to an X-ray examination, which revealed an endosteal growth.

Assuming that the milder measures of massage, exercises and passive movements have been tried without effect, or with only partial success, the main points relating to the desirability or the reverse of resorting to the forcible bending of a stiff knee may be summarised generally as follows :

(1) The less the movements of the articulation are restricted the better is the prospect of the radical method.

(2) Fibrous ankylosis resulting from tuberculous disease, unless very slight indeed, should not be forcibly broken down. If in such cases the joint be fixed in a position which is inconvenient or painful to the patient, rectification of the deformity should be effected by an open operation, and not by "breaking down."

(3) A stiff joint which is hot to the touch whilst it contains no fluid is unfavourable for forcible bending, the condition being usually due to tubercle in a quiescent stage. Forcible bending in such cases is commonly followed by the lighting up of the quiet tubercle, which may result in abscess or worse developments.

(4) A stiff joint which is hot to the touch whilst it contains fluid is not unfavourable for breaking down unless ankylosis is present, heat with effusion being commonly due in chronic incomplete stiffness to the dragging upon adhesions, the rupture of which cures the symptoms. If the ankylosis is complete, or

nearly so, and there is coincident effusion and heat, breaking down of the joint should be conducted with great care and caution, as in such cases there sometimes exists a small area of diseased bone in the joint or immediately outside it.

(5) Effusion without appreciable heat may be ignored for ordinary purposes in deciding as to the propriety of the forcible bending of a joint.

(6) The less the muscles acting on the joint are wasted, and the better their physiological condition, the more freely, *cæteris paribus*, may attempts at breaking down be approached.

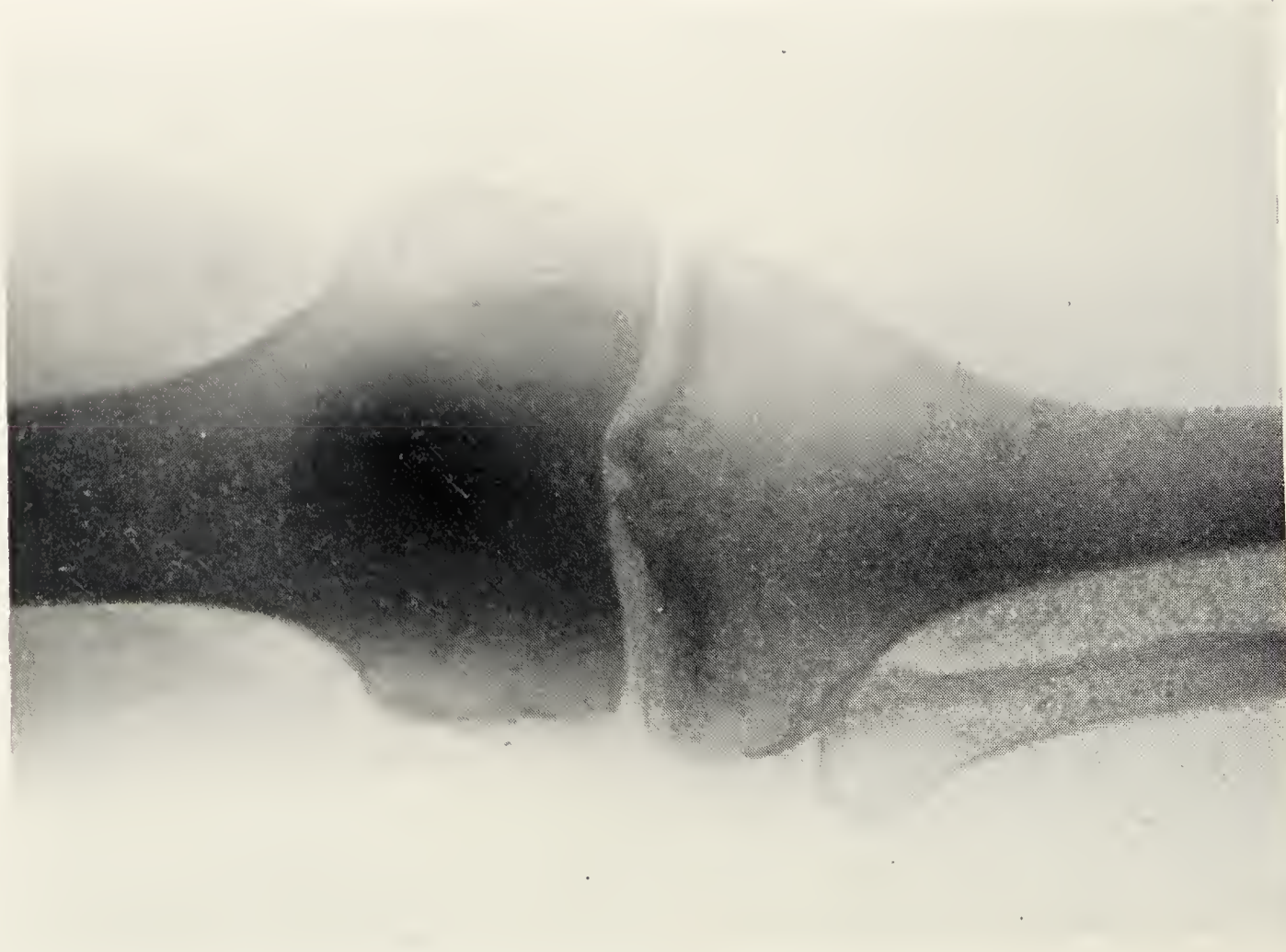
(7) Rigid or adherent muscles should be regarded as unfavourable factors in this treatment, but are not always insuperable objections.

(8) Wasted muscles which are not rigid may be disregarded, except in very long standing cases, in which extreme muscle-waste is invariably associated with weakening of the bones. Such cases, therefore, should obviously be approached with caution.

(9) The ideal condition of a stiff knee for the purposes of the radical treatment by breaking down may be said to be as follows ; Moderate stiffness, absence of heat and effusion, with normal muscles. Any joint which is not absolutely stiff, which is not hot to the touch, which contains no fluid, and in which the muscles acting upon it are not rigid or adherent, may be broken down with impunity.

(10) The neurotic element in stiff joints must be

PLATE VII.



borne in mind. A stiff knee which is without increased local heat and effusion may, if the muscles are not wasted, be regarded for practical purposes as neurotic in origin.

Points relating to the details of forcible manipulation.—The following summary includes only the more important points relating to the method of procedure, and is, of course, in no sense exhaustive. But the points referred to are, so far as my experience goes, those which are most worthy of note.

(1) Although not invariably necessary, an anæsthetic should be given. The anæsthesia must be profound, and the behaviour of the muscles of the affected part should be observed whilst the patient passes under the influence of the anæsthetic. The more these muscles twitch and contract during this period, the better, as a rule, is the prospect of the treatment. In neurotic cases free spontaneous movement of the stiff joint frequently occurs at this time.

(2) All attempts at the breaking down of a stiff joint should, unless circumstances make it impracticable, be preceded by a methodical course of massage and passive movement. This is especially indicated when the muscles are rigid and apparently adherent. The effect of a course of massage in such cases is often very marked in lessening the rigidity of the muscles, and frequently leads to considerable diminution in the stiffness of the joint. Joints treated

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in this way often become easily manageable by breaking down after the massage, although the treatment may have previously appeared almost hopeless.

(3) The first forcible movement made in attempts at breaking down a knee-joint should be flexion. Extension should never be employed as the first movement.

(4) The opposing force across which the joint is bent should be placed exactly in the line of the articulation, and not upon the bone immediately above that point. When possible, the whole length of the femur should be applied to a flat surface—a table, for example, the end of which, with a thick blanket laid over it, should be exactly in the line of the articulation. The thigh should be kept firmly applied to the flat surface by the hands of an assistant whilst the manipulator manages the leg.

(5) The attempt at flexion should be made by means of steady intermittent movements, not by one sweeping motion. Extension should be made by one continuous pull or push, the same precautions being taken about the position of the opposing medium, as has been indicated in speaking of its use in flexion.

(6) It is of importance that no attempt at extension should be made until after the greatest possible amount of flexion has been effected. In other words, the breaking-down process should be considered primarily to consist of two stages, which are quite distinct—first flexion and then extension, the

first being complete before the second is commenced.

Treatment subsequent to the breaking down of a stiff knee.—On this matter there is little that requires notice. No splint of any kind should be used. Massage and passive movement should follow immediately, *i. e.* within twelve hours, if possible. Voluntary movements must be encouraged as much as possible, even at the cost of considerable pain. The only indication for the interruption of the movements is extreme local heat and tension of the joint; tension without material increase of local heat may be ignored. It must never be forgotten that adhesions are most liable to re-form in the course of the first three or four days after their rupture; it is during this period that free movements are most urgently called for, and this is the time which, even now, is wasted by some practitioners by confining the limb in a splint.

In difficult cases it is wise, in the majority, to give an anæsthetic again on or about the fourth day (not later), if there is any doubt about the amount of mobility obtained at the first operation being preserved.

When it has been found possible to effect only a partial breaking down of a stiff joint, the succeeding attempts at getting a complete result should not be postponed too long. A week is the longest interval which should be allowed, in the absence

of special circumstances, between the first and following attempt.*

Ankylosis of the knee-joint.—Assuming that complete ankylosis exists, whether from very firm, fibrous adhesions (false ankylosis) or from bony union (true), the question arises whether it should be left alone or whether attempts should be made after dividing the uniting medium of bone or fibrous tissue, as the case may be, to attempt to obtain a movable articulation by arthro-plasty, which means (1) the complete removal of all abnormal material uniting the articular ends of the tibia and the femur, as well as any connection between the patella and the femur, and (2) the introduction of large flaps of fascia lata, turned down from the front of the thigh, between the ends of the tibia and the femur, and fixing the ends in such a way to the posterior ligament, etc., that all possibility of re-union between the bone ends is prevented; re-union between the patella and the femur being prevented by the introduction of a fascial flap between the two bones, the subsequent treatment being directed, by means of massage and movements, towards the formation of an artificial joint (Fig. 16).

Having regard to the remarkable usefulness of a firmly ankylosed and painless knee—patients, for

* It is not impossible that intra-muscular injections of fibro-lysin may prove to be of service in softening adhesions in stiff joints, but my experience at present does not justify the expression of any useful opinion upon the subject.

example, in my own experience having been able to walk fifteen to twenty miles in a day, to shoot,

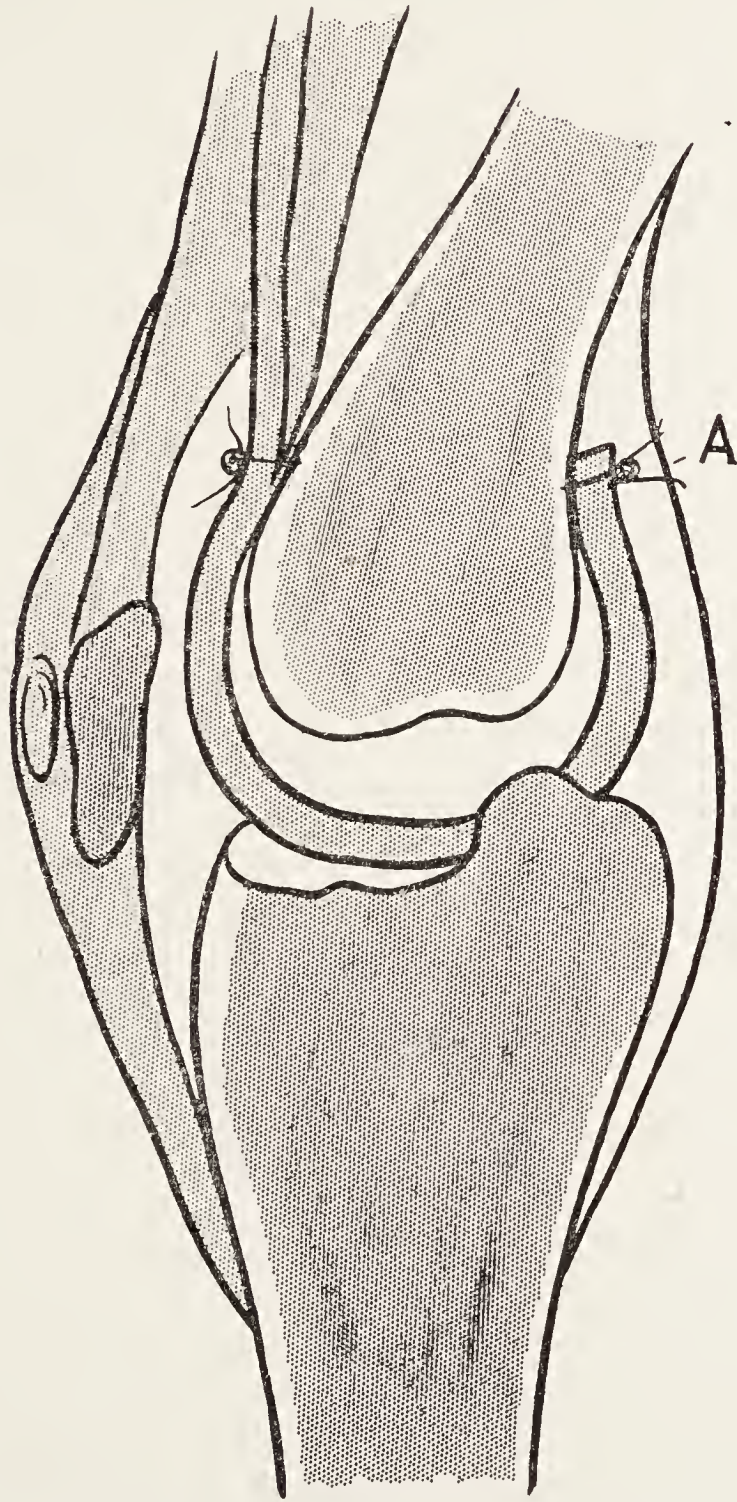


FIG. 16.—Arthroplasty. Diagram of a section through the knee-joint showing the femur and tibia completely separated by a fascial flap sutured to the periosteum at A. (After Murphy.)

bicycle, etc.—in my opinion matters are better left alone in cases of this kind until it has been demonstrated that a more useful limb can be produced

with certainty by arthro-plasty. In the case of fibrous ankylosis, if the adhesions are too firm to admit of breaking down with safety, and are at the same time not sufficiently firm to make the limb rigid, or if pain arises in the course of using the limb, arthro-plasty is worthy of consideration. In any case in which the ankylosed limb, whether the union be bony or fibrous, is fixed in a good position, that is to say in a position which is good for the purposes of the patient, I should hesitate to interfere with a view to getting a movable joint unless use of the stiff limb caused pain.

On the other hand, if the position be bad, the right plan is to open up the site of the joint and proceed either to the performance of arthro-plasty or to the production of a stiff joint in a good position, according to the circumstances of the case.

CHAPTER XIII

ALTERATION IN THE SHAPE OF THE KNEE-JOINT CONSEQUENT UPON DISEASE AND INJURY.

ALTERATION in the shape of the knee may result from changes confined to the soft parts, from modification in the contour of the bones, or from abnormality in the axis of the tibia or femur.

Changes in shape dependent upon conditions of the soft parts may be further divided into those in which the synovial membrane and capsule of the joint are involved, and those which are independent of these structures. Alteration in form consequent on conditions affecting the synovial apparatus and capsule are most commonly due either to chronic effusion leading to uniform swelling which may vary in degree from a slight fulness to the large distension of *hydrops articuli*, or, less commonly, to general swelling of the whole synovial apparatus in tuberculous disease, due in the early stage to fluid followed later by the formation of abundant granula-

tion tissue of the gelatiniform kind; and to the effusion which most rapidly shows itself in change of shape, viz. that occurring in Charcot's disease.

In the slighter form of apparent general swelling of the joint care should be taken to be sure that the swelling of the joint is real, and not merely apparent in consequence of wasting of the thigh muscles. It is quite curious how frequently the wasting of these muscles leads to the conclusion that the knee is swollen, especially by patients, although the mistake is not entirely limited to them; a comparison of the two limbs, which should, of course, always be made, immediately corrects the misapprehension. Care should also be taken to avoid mistaking for organic change the general œdema which follows prolonged immobilisation of the knee in a splint fixed by bandages above and below the joint. The way in which the various points of the articulation are veiled, the pitting on firm pressure, and the rapidity with which the condition subsides spontaneously or after a little massage, should be sufficient to proclaim its real nature.

Chronic effusion, if it continues sufficiently long, especially in osteo-arthritis, leads almost invariably to irregularity of outline, either by causing a bulging outwards of some part of the capsule, usually on one or other side above the patella, or by leading to distension and increase of size of one or more of the synovial bursæ which communicate with the joint.

When the effusion in the joint is only slight, or, at all events, moderate in degree, as is often the case, the first thing to attract the patient's attention to any abnormality is frequently the localised swelling caused by the distension of one of these bursæ, or by the formation of a synovial extension cyst (Baker's cyst). In all cases, therefore, in which local cystic swellings are complained of, the probability of implication of the joint must be kept prominently in mind, especially when they are in the situation of bursæ which normally communicate with it. In middle age and after, cystic swellings occurring in abnormal situations below the line of the joint may generally be considered to be synovial extension cysts if there is any evidence of joint affection and therefore offshoots from the articulation.

In the young similar swellings in the situation of bursæ normally communicating with the joint, when there is evidence of joint implication with local heat, is suggestive of tuberculosis if the trouble is very chronic, especially if no history of injury is forthcoming.

The treatment of these conditions is primarily directed, of course, to the original causes of the effusion, *e. g.* syphilis, rheumatism, tubercle, etc. The local indications are the removal of the effusion or other abnormalities and the correction of the weakness of the muscles, which is always associated

with articular lesions of this kind. When excessive, effusion may be got rid of by aspiration, followed by elastic pressure and massage, and perhaps induced hyperæmia. Palliative means, such as iodine inunction or the use of Scott's dressing, effect comparatively little good. In very chronic cases of hydrops injections of the joint with weak solution of iodine or diluted Morton's fluid may do good, but are not without risk of exciting acute inflammation of the joint with its several possibilities. The most interesting question of treatment arises, however, in connection with the bursal enlargements and extension cysts. Speaking generally, if no pain or inconvenience is felt, as is often the case, they are better left alone, as they have a habit sometimes of disappearing spontaneously, perhaps to reappear again and again, disappearance of one swelling being often followed by the occurrence of another in a different situation. If, however, trouble arises from pain or restriction of movement, or when increase in size, especially if rapid, occurs, the only plan of treatment is removal, bearing in mind that the cysts communicate with the joint and that the communication between them and the articulation requires to be closed at the time of operation. At the same time it must be admitted that removal is no certain prevention of recurrence if the intra-articular condition remains unchanged. In children and growing subjects, when bursæ of this kind make

themselves manifest not long after injury, they may generally be safely left alone, as moderate restriction in use and protection from further injury generally lead to their disappearance. When coming on as a development in tuberculous disease of the joint their treatment must of course be secondary to that of the articulation.

In the absence of evidence of implication of the joint, fluid swellings over the lower end of the femur or the upper end of the tibia, whether tender or not, are suggestive of cold abscess, sometimes tuberculous, with or without underlying bone disease.

After early adult life distinctly cystic swellings in situations remote from that of the normal bursæ over the end of the femur or tibia should lead to very careful examination of the condition of the bone by means of the X rays and otherwise, as they may be an indication of cystic bone disease, sarcomatous or benign. Dermoids and hydatids may present themselves in a similar way in these situations, but with great rarity. In speaking of tense cysts it may not be amiss to say that it is practically impossible in many cases to determine, excepting by exploration, whether the contents are fluid or soft solids.

The causes of alteration in the conformation of the soft parts independently of the capsule and synovial apparatus are principally the various tumours arising from disease of the several independent

bursæ (*e.g.* the bursa patellæ), nævi and large varices about the inner side of the knee as a rule ; popliteal lipomata, popliteal aneurysm and new growths, concerning which no special comment is necessary, excepting to emphasise two elementary facts which seem sometimes to be forgotten, the first being that apparent diminution or disappearance of a tumour behind the knee on flexion is no conclusive evidence that it communicates with the joint, although of course it may do so ; the second is the necessity of what I am constantly insisting upon, namely the examination of the knee in every case in the standing as well as the recumbent position. A striking case in illustration of the latter point is the following :

CLINICAL EXAMPLE No. 31.—A stoutish man, aged about sixty years, had for some time suffered from rheumatic pains in different parts of his body, for which he had been treated in many ways, with various degrees of success. The pains finally centred about the left shoulder, and later on symptoms of angina pectoris developed, but under treatment disappeared. He was in the habit of consulting me about his shoulder at long intervals, and on one of these occasions asked me to look at a “ bursa ” behind his knee, which he had been made to understand was associated with a rheumatic condition of the joint. He had been seen by three medical men, all of whom agreed as to the diagnosis ; local applications of iodine and

similar drugs had been prescribed, in spite of which he thought the swelling was increasing, although it gave no trouble. He was standing before me at the time, and in passing my hand over the popliteal region outside his clothing I readily felt in the usual situation of a popliteal bursa a swelling as large as a walnut, which certainly pulsated. On removing the clothing and examining the knee in extension the condition was obvious to the sight as well as to the touch, but on flexion, the patient being recumbent or seated, although the lump could be felt, there seemed to be no more pulsation than might have been conveyed by a normal popliteal artery. On inquiry it appeared that the swelling had never before been examined in the standing position, but only when the patient was sitting with the limb more or less flexed, hence the oversight, which would have been very easy under such circumstances when the tumour was much smaller than at the time of my examination. It was in reality a popliteal aneurysm.

Adventitious bursæ connected with the employment of the patient, sometimes of large size, may lead to remarkable distortions; the most exaggerated case of this kind coming within my experience is the following :

CLINICAL EXAMPLE No. 32.—A man of middle age came to see me at St. George's Hospital on account of swelling of the right knee, which was so

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large that his quite capacious trousers were tightly stretched over it. Upon examination the knee was of very large size in consequence of a fluid swelling, which overlapped the upper three inches of the tibia and the inner side of the joint as high as the upper edge of the patella; it was entirely extra-articular, the knee-joint being apparently normal and free and painless in its movements. Upon inquiry it transpired that he was a carpet layer by occupation, and this swelling had commenced at the spot upon the side of the knee which he was continually knocking against the rake as he laid his carpets. Upon being assured that the swelling was not "cancer," which he feared, he declined treatment, as he could do his usual work with comfort as he was.

Plate IX shows another exaggerated form of "occupation," bursa—pre-patellar—in a man, an Italian, whose occupation was laying mosaic pavements. He stated that it was a common condition amongst workmen of his kind.

Alteration in conformation from changes in the shape of the bones.—These osseous changes may occur in the femur, in the tibia, or in the patella, separately or together. The causes of the changes involving the three constituent bones are, for practical purposes, limited to osteo-arthritis, arthritis deformans, and Charcot's disease. Tuberculous disease of the joint may lead to simulation of alteration in the shape

PLATE IX.



A pendulous pre-patellar bursa in a man.

of the bones, but these are not often changed in form in any material degree, the deceptive appearance being as a rule due to thickening of the soft parts over them, as can easily be demonstrated by the use of the X rays.

The diagnosis between osteo-arthritis, arthritis deformans, and Charcot's disease should not be difficult, having regard to the history and the nervous signs, but care must be taken not to rely too much upon absence of the knee-jerks as a differential symptom, as they are in certain conditions of swelling about the lower part of the knee unobtainable in normal subjects; moreover, they are occasionally absent in perfectly healthy people; for an example, a distinguished man of great intellectual powers, who died not long ago at a great age, stated that he had never had knee-jerks.

Alteration in shape from increase in size of the lower end of the femur, or of the upper end of the tibia, may be uniform, one-sided, or nodular. Uniform general enlargement, limited to the lower end of the femur in young subjects, may be due to tuberculous osteitis, with or without abscess, chronic epiphysitis or par-epiphysitis in congenital syphilis, and sometimes to malignant disease (endosteal sarcoma). When affecting one aspect only (generally the inner side) bony enlargement is usually tuberculous in origin; it may be syphilitic, and in rare instances it may be due to periosteal sarcoma. The

same causes may account more rarely for enlargement of the upper end of the tibia.

Chronic enlargement of one of the bone ends after middle age should be watched with suspicion, as it may be the first indication of endosteal sarcoma. Should a uniform enlargement under these circumstances become irregular or nodular endosteal sarcoma is almost certainly present.

Changes in the patella rarely lead to altered conformation of the knee, although the solid gumma of the patellar bursa at times very strongly resembles bony outgrowth; it is, however, on careful examination always movable to some extent upon the subjacent knee-cap. I have seen the patella the seat of tuberculous disease, quite independent of the knee-joint, stand prominently forward as a hard, rugged mass, and I have removed a pedunculated exostosis from the lower and front aspect of the patella as large as a walnut. The most remarkable case, however, with which I have met, in which the patella was implicated in altering the shape of the knee, was the following, in which a large portion of the synovial membrane appeared to have become ossified :

CLINICAL EXAMPLE No. 33.—The patient, an Eurasian, came to see me at St. George's Hospital on account of some stiffness and swelling of the knee. He was aged thirty years, and apparently healthy. The right knee could be flexed to something short of a point midway between extension and semi-flexion.

PLATE VIII.



A case in which general swelling of the knee had been present for some months without causing inconvenience until sudden weakness was felt whilst walking. X-ray examination revealed a large endosteal growth which had led to spontaneous fracture.

To face page 178.

There was no pain or other inconvenience, but he stated that the knee had been altering in shape for about eighteen months, during which the range of movement had become gradually less. On examination, the outer side of the front of the right knee seemed to be occupied by a hard, somewhat irregular, bony mass, into which the edge of the patella seemed to merge. The mass was slightly movable, and obviously involved the capsule and synovial membrane ; its edges were irregular, and at its upper end it faded away in the supra-patellar pouch ; whilst handling it the lower edge collapsed a little with a kind of egg-shell crackling sensation. An X-ray photograph taken by Mr. Swinton showed a large opaque mass of the same density as bone. The patient left the hospital promising to return for admission, but he did not reappear. At the time I was inclined to think that the case was one of ossifying sarcoma, but I have now no doubt that it was a rare example of ossification in connection with the synovial membrane similar to that recorded by Mr. Joseph Griffiths and Mr. Milligan in the 'British Medical Journal' of 1894. I have never seen so extensive a case, although isolated plates of calcification are not uncommon in the synovial membrane in certain cases of osteo-arthritis.

Isolated bony masses at the upper level of the condyles on the inner side or at the line of the tibial epiphysis are generally exostoses. In connection

with these isolated masses the possibility of disease of the head of the fibula must not be overlooked. Thus I have seen a large, hard, isolated tumour, caused by tuberculous disease of this bone, have found an endosteal sarcoma the cause of its enlargement, and have removed a nodulated osteoma from it of considerable size. If two or more bone-like masses, apparently exostoses, are present in the neighbourhood of the knee, especially if they occur in both limbs, it is well to examine the skeleton generally, especially the costo-chondral junctions, to ascertain whether other tumours of a similar kind exist; should they do so they are probably sarcomatous, the patient being the subject of sarcomatosis. I have seen certainly two such cases in my own experience.

Changes in shape consequent upon alteration in the axis of the tibia and femur in previously normal limbs.—Alterations in the conformation of the knee from this cause are for clinical purposes of two kinds, one in which the alteration is due to angular distortion such as may arise from hyper-extension of the leg upon the thigh, or bending of the leg outwards or inwards at the knee; the other in which horizontal displacement, partial or complete, of the articular surface of the tibia from that of the femur takes place.

(1.) *Angular deformity at the knee.*—This may result from the gradual increase of a natural

peculiarity such as slight knock-knee ; from laceration of ligaments in injury or from their weakening by disease ; or from alteration of the horizontal line of the articulation in consequence of change in the shape of one or other of the articular surfaces.

It will readily be seen that in some subjects certain peculiarities, for example slight genu valgum, not in itself enough to constitute a real abnormality, would tend to increase towards the convex side in the event of weakening of the soft parts, especially if the muscles, as would generally be the case, were wanting in proper tone or power. In cases of this kind the whole articulation will be found extremely lax. Similar deformity may result from unnatural rigidity or spasm of the muscles on the concave side of the bend, in which case the laxity of the joint will be absent. In the diagnosis of this form of knee distortion care must be taken to be sure that the defect is at the knee-joint and not in the bone immediately above or below, especially when outward bowing of the knee or hyper-extension is present, as the alteration may be due, not to a defect at the joint, but to bending of the tibia or of the femur below or above, such as may happen in some cases of rickets and in osteitis deformans. In deformity resulting from hyper-extension, called, when excessive, genu recurvatum, the causes in children are generally infantile paralysis, frequently bilateral, or long continued traction in the treatment of hip-joint disease

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or fractures of the thigh ; later in life, it is most frequently caused by tabes or injury involving damage to the crucial ligaments, which is a much more important factor than giving way of the posterior ligament, to which so much importance is commonly attached in such cases : in fact it may be accepted as a truism that if after an injury of the knee real hyper-extension follows there has been some laceration of one or both crucial ligaments.

In cases in which the same defect occurs in osteo-arthritis so-called the crucial ligaments may be so changed that for practical purposes they are non-existent.

In the genu recurvatum of young children from infantile paralysis the cause of the trouble sometimes escapes notice because upon ordinary inspection no wasting of the limb is apparent unless special attention be directed to the back of the thigh in the standing position, when the shrunken condition of the flexor muscles will be at once apparent. The most interesting of these distortions are those in which lateral angular change in shape depends upon alteration of the line of the joint from the horizontal to the oblique. In young subjects this is usually due to irregular growth of the epiphysis following upon injury or disease, *e.g.* syphilis or tubercle, and is sometimes the result of certain occupations. Rickets I do not include here, as it is a condition associated with general abnormalities in

PLATE X.



A case of injury to the knee (said to have been fracture) some years before coming under observation, which was followed after an interval by gradual and painless change in shape (genu valgum), the joint being freely movable until about two years after the injury, when it slowly became quite stiff.

the skeleton, the knee being concerned merely as a part of a general mis-arrangement.

It is sometimes found after a severe injury to the knee, generally considered to be a bad sprain, that the patient recovers apparently in a satisfactory way, but later on, after weeks or possibly months, it is noticed that the limb is bending inwards or outwards at the knee (Plate X). In such circumstances the injury is almost certain to have been an oblique fracture involving one condyle or one side of the upper end of the tibia. The following is an excellent case :

CLINICAL EXAMPLE No. 34.—A young man, aged twenty-two years, strong and healthy, consulted me on account of genu valgum of an exaggerated kind, which was said to have come on rather rapidly during convalescence from a severe wrench of the knee. An X-ray photograph showed very plainly that the external condyle had been detached by an oblique fracture and had glided upwards, so that when attempts at walking were made the leg necessarily bent outwards. In connection with this type of lesion it is interesting to recall the fact that a few years ago “sprains” of the hip were spoken of as being sometimes followed by shortening of the limb from a mysterious change in the bone, which was thought to bring about an alteration in the angle at which the neck of the femur left the shaft. The X rays have abundantly shown that the common

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cause of this deformity is undetected fracture of the neck of the thigh bone, and in a few cases injury to the epiphyses in growing subjects.

The way in which the mechanical irritation of a growing epiphysis may cause angular deformity at the knee—traumatic genu valgum—is shown by the following case :

CLINICAL EXAMPLE No. 35.—A boy, aged twelve years, in cutting a hedge, stuck the end of the bill-hook into the lower part of the left knee. Some inflammation followed, and he was laid up for three weeks or thereabouts, but so far as I could ascertain no symptoms of knee-joint implication supervened. Twelve months later it was noticed that the knee was “growing in,” *i. e.* projecting inwards, the seat of the injury having been more or less painful from time to time, but not in any way interfering with the use of the limb. The deformity continued to increase slowly, and I was consulted eighteen months after the accident on account of extreme tenderness over the part. There was considerable genu valgum ; upon examination, the inner side of the head of the tibia was thick, and although the line of the knee-joint was normal the leg was so much abducted that there was an interval of nearly five inches between the malleoli when the patient was lying down, with the knees in contact, the sound limb being straight and normal. Over the centre of the projecting part of the thick tibia was a very tender and

PLATE XI.



Irregular growth (? tubercle) of the condylar epiphysis of the femur
after injury.

softish spot. I explored the tender area and found a small piece of cloth, which had evidently been carried in by the point of the bill-hook. The epiphysial cartilage was almost an inch in thickness at the inner side and fully accounted for the bending out of the leg.

Plate XI is an X-ray photograph, showing a similar condition caused by a severe wrench ; the patient, a boy, fell from a ladder, his leg being caught between two of the rounds as he fell.

Similar results may follow tuberculous and syphilitic epiphysitis of limited distribution.

With regard to the treatment of cases of this kind, it is clear that when the defect—constitutional treatment in specific cases having, of course, been adopted—has not gone too far, the indication is to strengthen any weakness of the muscular apparatus by massage and resistance exercises aided by electricity if it seems appropriate.

In genu recurvatum resulting from injury, the wearing of an instrument similar to that shown in Fig. 4 with a stop to check extension at the point at which the leg is in a straight line with the thigh is, as a rule, the only feasible treatment, although in rare cases it may be justifiable to consider the propriety of an osteotomy, with a view to setting the lower end of the femur at an angle at which, when the leg has reached its limit of abnormal extension, the limb would be straight. In cases resulting from

infantile paralysis in infants and young children, when the normal condition is not regained it is generally possible, by proper instruction, to drill the patients into correcting the defect at first by voluntary effort, which later becomes automatic.

Lateral deviation, due principally to muscular relaxation, or to ligamentous softening or stretching, can be rectified by instrumental means, and I have not myself been able to achieve any material success by the opening up and shortening of the capsule in cases of this kind. At the same time, as in experienced hands this proceeding ought not to be harmful, whilst it is conceivable that some benefit may accrue from its employment, it is justifiable. When the deformity is due to overgrowth of the epiphysis or to malformation in fracture, nothing short of osteotomy will correct the defect, and it is the proper treatment if the abnormality or disability be sufficient to make it worth the patient's while to submit to the operation.

(2) *Horizontal displacement, partial or complete, of the articular surface of the tibia from the femur.*—Except as a result of traumatic dislocation, with which we are not now concerned, this is rare, and can only occur as a consequence of disorganisation of the joint by disease, principally tuberculosis and pyæmia.

Remarkable changes of this kind sometimes happen, of which the following is a singular instance :

CLINICAL EXAMPLE No. 36.—A youth, aged twenty years, had been laid up for several months on account of pyæmia, due apparently to infection from a faulty drain. A large abscess in the buttock and another in the axilla had formed, had been opened and had healed. One shoulder-joint, the right wrist, and the left hip had at different times been involved, but the effusion which had developed in each case disappeared spontaneously, the disappearance of fluid in any one joint being followed by its appearance in another. Finally, the right knee became distended, but, as usual, was only a little painful. The fluid disappeared but very slowly, six weeks being occupied in the process, the limb having been kept upon a splint, the general symptoms all this time being those of chronic pyæmia. After the disappearance of the fluid from the knee the splint was left off. Shortly afterwards, whilst the patient was being raised for the purpose of using the bed-pan, he complained of sudden pain in the knee, which, when seen by the nurse subsequently, was out of shape. Upon examination there was a nearly complete dislocation of the tibia outwards, which was reduced with ease, the joint being afterwards put up in an immobilising splint with a view to obtaining ankylosis.

It is clear that in this case a quiet disorganisation of the joint had taken place of the same kind that I have seen happen in the hip in cases of enteric fever.

CHAPTER XIV

INJURIES IN AND ABOUT THE KNEE-JOINT

SETTING aside the injuries already dealt with in considering internal derangements and modifications in the movements of the knee-joint, there remain for brief consideration—dislocation of the tibia from the femur, fracture of the condyles of the femur and of the upper end of the tibia when involving the joint; injuries of the patella and the parts in immediate relation with it, and the rather rare conditions of fracture of the neck of the fibula and separation of the adductor tubercle of the femur.

Injuries involving the tibia and the femur.—*Dislocation of the tibia from the femur* is uncommon. A search of medical literature may show records of 250 cases or thereabouts. My own experience is limited to three cases: in one the displacement was backwards, in one outwards and in one inwards; both the latter were associated with rotation of the leg. The diagnosis was obvious and reduction in each was easy by means of traction, the patient being under the influence of an anæsthetic.

PLATE XII.



A complete dislocation of the tibia from the femur caused by a fall into the hold of a barge. Seen stereoscopically the bones are quite separated.

Considering the extreme amount of laceration and damage to which the internal mechanism of the knee must be subjected in complete dislocation, it is remarkable that such perfect recovery as may sometimes occur is possible.

CLINICAL EXAMPLE No. 37.—A man, aged twenty-six years, was thrown from a bicycle, falling upon his right knee, which immediately became fixed in a slightly flexed position, the foot being turned outwards. When seen five hours after the accident the tibia was dislocated completely outwards, the soft part being tightly stretched over the inner condyle. Reduction was easy; the swelling of the joint, at first great, rapidly subsided, and at the end of ten days, a splint having been worn for a week, the patient could voluntarily bend the leg nearly to a right angle with the thigh, and at the end of six weeks was walking with very little lameness.

It is an interesting speculation as to what happens to the crucial ligaments in cases of complete dislocation: it seems almost impossible that they can be torn away from their connections when complete recovery in a comparatively short time takes place; at the same time it is almost inconceivable that they can remain intact when the range of displacement is so great as it must be in these apparently complete dislocations. In young subjects care must be taken to discriminate between displacement of the femoral epiphysis and dislocation. In a boy, aged eleven

years, whose case I had under observation, an apparent forward dislocation of the tibia, with impending gangrene of the foot and leg, proved to be a nearly complete displacement forwards of the condylar epiphysis of the femur with fracture.

The treatment of these cases is obvious, that is to say, immediate reduction, especially in the case of the forward displacement, on account of the possibility of gangrene from stretching and occlusion of the popliteal artery. Reduction is generally effected with ease under an anæsthetic by traction, or by manipulating the head of the tibia into its proper place, the leg being flexed as much as can be done without the exercise of force. After reduction the limb should be immobilised for a week, preferably less, and never more unless acute inflammatory symptoms in the joint develop; massage, passive and voluntary movements follow. In six weeks at the most the patient should be walking with freedom. If laxity of the joint, as sometimes happens, follows, a mechanical contrivance of the type shown in Fig. 4, worn for two or three months, will probably restore the required tone if exercise is at the same time freely taken.

It is worthy of note, especially in relation to malin-gering, that in some subjects the looseness of the joints is normally such that it is easy to produce voluntarily and to maintain for lengthened periods a condition of nearly complete dislocation of any of the

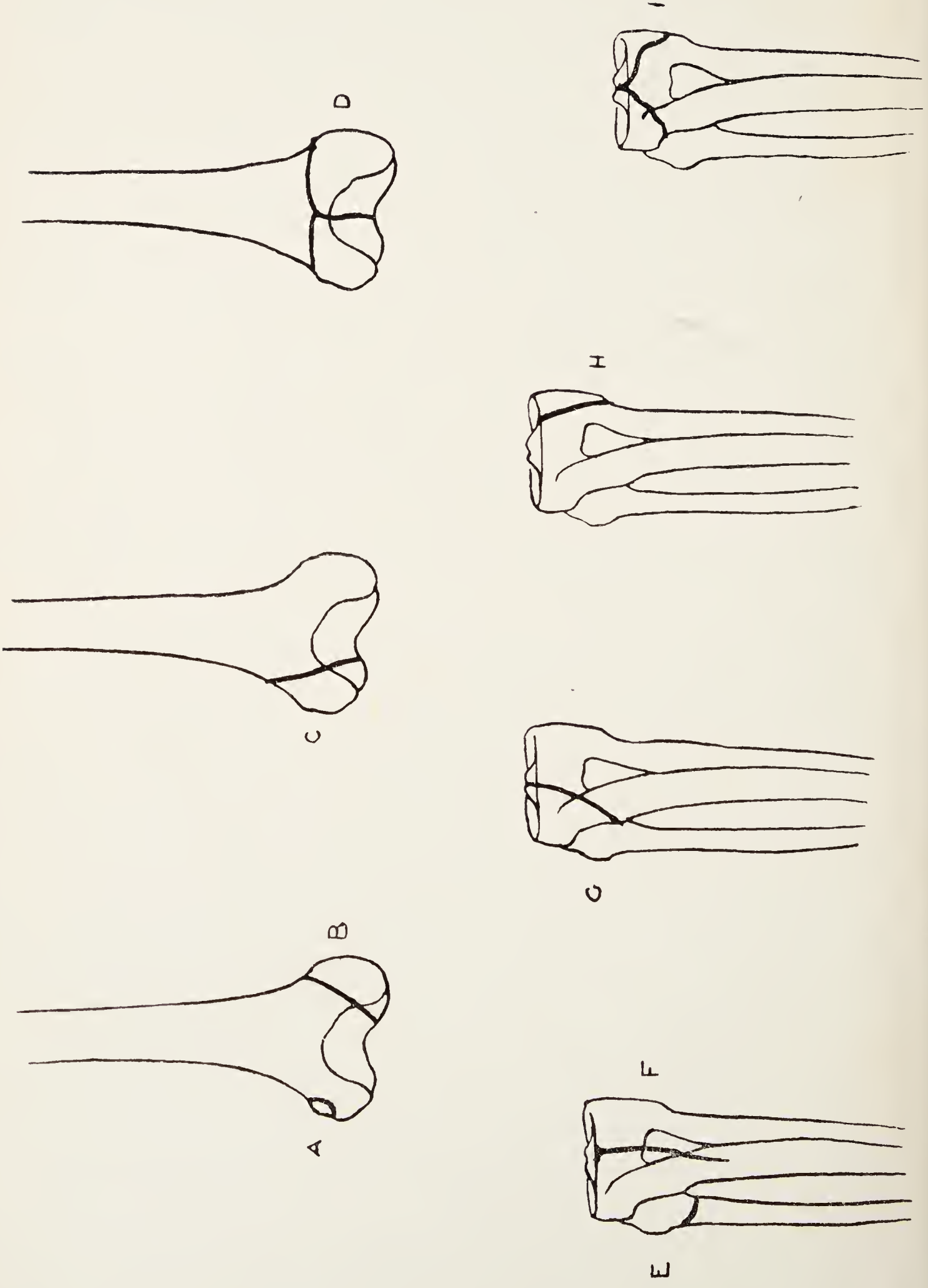
major joints. Some twenty years ago or thereabouts there went the round of the London Hospitals a man who could produce these nearly complete dislocations at will in any of the larger joints, including the knee, in which the displacement was backwards, the condyles of the femur projecting under the soft parts in front with a clearness which could only have been exceeded by actual exposure by dissection. Reduction by manipulation of these dislocations was impossible without an anæsthetic, but voluntarily he could at once, without apparent effort, correct the deformity. I well remember giving a demonstration in the large theatre of St. George's Hospital upon the various dislocations which could voluntarily be produced by this man.

Fracture of the femur and of the tibia involving the knee-joint.—The principal varieties of the injuries are shown in the diagrams included in Fig. 17.

The diagnosis of these fractures, simple as it may be in the majority of cases, is not always easy in consequence of the occasional absence of crepitus, especially in the oblique fracture of the outer side of the head of the tibia, in which the movement of the detached fragment is restricted by its attachment to the head of the fibula. In every injury of the knee-joint, therefore, which is associated with sudden or rapid effusion, an X-ray examination should immediately be made.

An interesting fracture, which, although not actually

FIG. 17.



involving the articulation, may give rise to symptoms simulating internal derangement, is detachment of the abductor tubercle of the femur by muscular violence. I am inclined to think that this injury is more frequent than is commonly thought; it is one of the lesions which have been brought to light by the X rays.

The following is a typical case :

CLINICAL EXAMPLE No. 38.—A man, aged twenty-five years, in getting over some railings slipped, his leg being caught between two of the rails as he fell across the top one. The thigh was bent violently outwards at the knee, with intense pain, which caused him to faint. When seen twelve hours later there was a good deal of swelling about the inner side of the knee and around the inner hamstring tendons. Voluntary attempts at adducting the thigh caused acute pain like that met with in “rider’s sprain.” Complete extension of the knee was impossible on account of the pain, but flexion was easy. Rotation outward caused pain on the inner side of the joint. In standing the limb was slightly flexed. Taken as a whole the symptoms were suggestive of superficial extensive bruising, with internal semi-lunar cartilage

FIG. 17.—Diagrams of the commonest types of fracture implicating the knee-joint, and of two (A and E) which, although not involving the joint, may simulate semi-lunar lesion. Separation of the adductor tubercle (A) of the femur is rare.

lesion. An X-ray photograph (Plate XIII) showed a separated adductor tubercle.

In the treatment of these cases massage and movements, as soon as the blood extravasation has diminished, seem to be the indications in a general way. If diagnosed at once it would be justifiable—although I doubt its desirability—to perform an open operation with a view to fixing the detached tubercle by a peg, pin, or screw. The results of the only cases, two in number, in which I have been sure of the diagnosis have been quite perfect after the treatment by massage and movements.

The deceptive symptoms of displacement of the external semi-lunar cartilage which may be produced by fracture of the head of the fibula without crepitus have been already referred to.

With regard to the treatment of fracture of the femur and of the tibia extending into the knee-joint, the question of the fixation of the fragments in position by operation naturally arises. Speaking generally, so far as my experience goes operation is rarely necessary, results sufficiently perfect being, as a rule, obtainable without. At the same time, if an X-ray examination shows much comminution and displacement, there is no doubt that the pegging or screwing the fragments together in their normal position, if successfully carried out, should shorten the period of recovery, and, in some cases, produce a better result. Whether this may be a sufficient

PLATE XIII.



A case of detachment of the adductor tubercle of the femur apparently by muscular action.

justification for operation must rest with those in charge of the case. It is, however, clear that the number of cases of this kind in which the operative treatment is justifiable must be restricted, since it must be confined to those which occur under conditions in which an aseptic operation can be with practical certainty carried out, both with regard to the operator and to the surrounding conditions. Such being the case—which can, I think, hardly be denied—the method of treatment of these cases without operation becomes a matter of some importance.

I have generally found the following plan succeed better than any other. The natural position of the fragments having been restored as far as possible by traction and manipulation as a rule under an anæsthetic, the whole limb is immobilised on a back splint in a position of slight flexion for a week, or until the immediate effusion into the joint has virtually gone. Massage of the leg and thigh is begun not later than the end of the first week, the patella when possible being moved daily to avoid adhesion or fixation—the most important point in assuring early free movement in the knee after injury. At the end of ten days or a fortnight the patient is encouraged to use gentle voluntary movement, aided at first by passive exercises very gently given by simply placing the hand under the knee-joint and lifting it upwards from the splint or bed. In the voluntary movements the main efforts of the patient should be

towards extension, that being the most difficult movement to completely restore in knee-injury. In a fortnight or three weeks, according to the nature and severity of the case, the splints may be discarded, good general support being afforded to the damaged parts by two or three layers of gamgee tissue firmly and uniformly bandaged in position. In six weeks the patient should be bearing weight upon the limb freely, but in oblique fractures of one or other condyle, or of the head of the tibia, it is wise that an instrument, something like that shown in Fig. 4, should be worn to prevent the occurrence of traumatic knock-knee from gliding displacement of the fragment, unless the patient, being in no hurry to resume walking, prefers to rest the limb for another month, using during that time voluntary and passive movements without bearing weight upon the limb.

Injuries involving, or in immediate connection with, the patella.—These include dislocation and fracture of the patella, rupture of the quadriceps extensor femoris at its junction with the patella, and rupture of the ligamentum patellæ.

Dislocation.—With the exception of cases of advanced genu valgum, in which, from the nature of things, the patella is liable to be pulled outwards by muscular action so that it occupies a position on the outer aspect of the joint, dislocation of this bone is rare ; but dislocation may occur inwards from direct violence, and outwards from direct violence or

PLATE XIV.



A case of oblique fracture of a femoral condyle which was followed by traumatic genu valgum.
To face page 196.

muscular action, the latter cause being more common in women by reason of their normal inclination to genu valgum ; it may also be produced in an inward direction by muscular action in “ bow-kneed ” subjects. The diagnosis is not difficult, the natural external position of the patella in genu valgum being borne in mind. In the absence of swelling the flattening of the parts in front of the femoral condyles allowing the inter-condyloid groove to be felt, and the position of the bony mass in its abnormal position are conclusive signs—the limb is fixed in extension.

The reduction of these dislocations is sometimes difficult, and, indeed, impossible without a general anæsthetic. The main indication is the relaxation of the quadriceps by flexing the thigh upon the abdomen followed, if simple manipulation fails, by sudden flexion of the knee, but at times after flexion of the limb upon the abdomen, very moderate manipulation will replace the bone. No splint should be used ; rest on a pillow for twenty-four or forty-eight hours to allow blood effusion to subside, followed by massage and movements—passive and voluntary—are the desiderata for speedy recovery.

Edgewise displacement or torsion of the patella, in which one edge of the bone is in contact with the front of the condyles, the other edge projecting forwards under the skin, is rare. I have seen one case only : in it the articular surface was directed outwards, the pain was acute, and the limb was

fixed in extension ; the cause was a fall from a haystack, after which the knee became fixed in the extended position. Reduction occurred spontaneously during the administration of an anæsthetic. In a case occurring in the practice of Mr. Henry Lee, at St. George's Hospital, the patella, during attempts at replacement, turned round so that the articular surface presented forwards—a rare, but not unknown condition, which is irremediable excepting by an open operation, which may also be required if manipulation fails in the edge-wise displacement. Recurrent dislocation of the knee-cap, excepting in cases of genu valgum, is uncommon, and its causes are obscure. As a rule no very great trouble arises, as spontaneous reduction generally follows immediately ; sometimes, however, great weakness of the limb results, and sudden falls may happen from abrupt stopping of the action of the knee. Attempts to prevent recurrence by mechanical means rarely succeed excepting in cases where great looseness of the joint exists.

I have not, myself, met with any case of this defect producing sufficient trouble to lead the patient to submit to operative measures, of which several have been suggested and practised, such as, for example, resection of a portion of the capsule of the joint with a view to holding the patella back in its place ; making a deep groove on the anterior aspect of the condyles, with the hope that its edge may pre-

vent the knee-cap leaving its normal situation ; transplantation of the tubercle of the tibia, and planting a retention peg in the femur on the side towards which the displacement occurs, with a view to preventing the patella being drawn away from its normal site. The most rational plan would, however, seem to be, if operation were urgently required, to correct the abnormal pull of the quadriceps upon the patella by an osteotomy of the lower end of the femur, such as is used in genu valgum.

Fracture of the patella.—Of the causes and symptoms of this injury I do not propose to speak; they are too obvious and familiar to require notice here. It may, however, be well to emphasise the fact that the separation of the fragments—the crucial point in the lesion—depends mainly upon two factors, the nature of the injury and the degree to which the lateral aponeurotic expansions to the capsule of the joint are torn. In a general way, direct injury, although greatly destructive to the integrity of the bone, inasmuch as the fracture is usually comminuted or “stellate,” is not associated with separation of the fragments, because the lateral connections of the bone remain intact, but it is a mistake to suppose that this is always so, as if circumstances lead to violent bending of the knee at the time of the injury separation may follow in the same way as happens in fracture from indirect violence.

In fracture from indirect violence, *i. e.* muscular

action, the amount of separation of the fragments will for the most part depend upon the extent to which the lateral expansions to the capsule of the joint have been torn. If these escape laceration the amount of separation will not exceed half, or, at the most, three quarters of an inch. If, on the other hand, they are freely torn, the separation may amount to anything between half an inch to three or four inches, or even more, the degree of immediate separation being largely determined by the amount of flexion at the moment of, and immediately after, the accident.

The principal interest, of course, in connection with fracture of the patella lies in its treatment, which resolves itself into a consideration of the question of operation as a routine measure under favourable conditions, and of the means available when, for reasons which seem sufficient, the radical treatment by operation is discarded.

In comminuted or stellate fractures resulting from direct violence, unless separation of the fragments has been caused by forcible flexion at the time of injury operation is unnecessary as perfect osseous union occurs quickly.

The question of operation in fracture with separation of the fragments is still of interest. Speaking generally, there is no doubt that all fractures of this kind are best treated by immediate suture—personally I think by open operation—when the patient

is sufficiently healthy, and if the circumstances and the surroundings of the case are compatible with the attainment of asepsis. These reservations are obviously important, and must necessarily put the operation out of court in a considerable number of cases. Moreover, it must be admitted that even now in the most practised hands and under favourable conditions the operation sometimes proves disastrous; one death, for example, has occurred in London during the past year after the suture of a fractured patella by the open operation. This in no way detracts from the merits of the treatment, but shows that it should be approached with a due appreciation of its possibilities. In perfectly healthy subjects in my practice I now suture every fracture of the patella due to indirect violence; in patients at a certain time of life, or who, although suffering from no gross organic disease, come under the head of "bad subjects for operation," operative measures should be limited to cases in which the separation exceeds half or perhaps three quarters of an inch, because in others as a rule as good results follow, although less quickly, without operation as with it. In patients who are subjects of renal disease, serious cardiac defect, or other conditions which render an operation unduly dangerous, I put aside the radical treatment altogether. In any case if circumstances make it impossible for the operation to be performed within forty-eight hours I think it

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is better left until the end of the first week after the receipt of the injury. As to the operation itself I have found the most satisfactory method to be the turning up of a large flap from the outer side of the knee-joint by means of a curved incision starting above from the middle line one and a half or two inches above the patella, and extending downwards to a point over the centre of the tibial tubercle ; the clot is cleared out of the joint, which I do not irrigate, and the fragments are brought together by two parallel sutures of silver wire or kangaroo tendon, according to the tension likely to be put upon them. In the event of the upper or lower fragment being too small to carry two sutures comfortably, one is sufficient, and I then use silver wire, which, if either fragment is very small, is passed through the aponeurosis above or below it as the case may be.

The subcutaneous methods recommended by some surgeons I have tried, but in my hands the results lead me to prefer the open method.

After the operation the limb is placed in a splint for twenty-four hours to avoid any violent movements during the recovery from the anæsthetic and then removed ; voluntary movements are encouraged immediately, and massage of the thigh muscles with passive movement of the patella follow in four or five days. At the end of a fortnight in a typical case, or at the most three weeks, all movements should be possible from extension to

a point midway between semiflexion and complete flexion ; in a month, or at the longest six weeks, the patient should be walking about.

Assuming that operation for one or other of the reasons I have mentioned has been rejected, the treatment becomes a matter for careful consideration and perseverance.

If the lateral aponeurotic expansions to the capsule escape laceration the amount of separation of the fragments, as already mentioned, does not exceed one half or three quarters of an inch : on the other hand, if they are freely torn the separation may be anything from half an inch to three or even four inches. In cases in which these parts are not torn, which is easily determined by noting the small amount of separation occurring between the fragments, although the distension of the joint may be considerable, a perfectly good limb should invariably follow without operation. If, on the contrary, the laceration has involved the lateral part of the capsule and its expansions extensively, a weak and sometimes sadly crippled limb may result unless the fragments are brought together by operation. It is, however, certain that even under such circumstances some limbs become perfectly strong and useful, sometimes, indeed, as useful as if no injury had been received, the long strap-like band of union appearing to provide all the stability required, although the fragments may be as much as four

inches apart. For an example, a coal-heaver, some time since under observation at St. George's Hospital, followed his ordinary occupation without any disability whatever in spite of fracture of both patellæ—the separation of the fragments on the right side being four inches and that on the left side two and a half inches.

As a matter of fact in the treatment without operation the final result is dependent, as I have said, principally upon two points: (1) The amount of laceration of the lateral expansions about the knee at the time of the injury (the less the lateral expansions are ruptured the more strength is there left in the joint after the fracture) ; and (2) the amount of mobility finally retained by the upper fragment of the patella. If this fragment does not contract inveterate adhesions, and finally becomes freely movable upon the femur, a useful limb follows, the strength of the limb, as a rule, then being in inverse ratio to the length of the uniting medium. If, on the other hand, fixation of this upper fragment occurs, then the interference with the mobility and strength of the joint is so great that the patient is much crippled.

The first object, then, in a case of a fracture of the patella, whether wiring has been practised or not, is to prevent, by constant manipulation, any chance of adhesions forming around the upper fragment and fixing it to the femur—a treatment

which excludes any form of splint which makes the patella inaccessible. The necessity for securing free mobility of the patella is not confined to cases of fracture, but if a rapid and perfect result is to be obtained it should be used in all cases of inflammation of the knee-joint, traumatic or otherwise, liable to be followed by stiffness.

This method of treatment makes the use of fixed immovable apparatus impracticable, such, for example, as plaster-of-Paris, silicate of potash, and the like.

The stiffness and pain which so often followed in fracture of the patella when treated upon the old lines were much more frequently due to the immobilisation treatment than to the injury. The best results which follow in cases not subjected to operative treatment will be obtained by immediate smooth massage and patellar manipulation, followed in a week or earlier by voluntary and gentle passive movement of the knee, during which the upper fragment should be firmly fixed by the hand of the manipulator in order to prevent its being drawn up towards the thigh. By this means, if effectually managed, flexion to a right angle can generally be accomplished without increasing the separation, and, in the majority of instances, a useful limb may be expected in from three to six months, all splints having been discarded at the end of the first month. It is remarkable how little stretching of the union

occurs in cases treated in this manner when care is taken from the outset to secure free movement of the upper fragment upon the femur.

Rupture or laceration of the tendon of the quadriceps extensor femoris.—Insignificant laceration of this structure arising from blows and strains is common, and requires no treatment other than that appropriate to ordinary sprains.

Partial rupture resulting from muscular action is not uncommon, although it frequently escapes notice unless seen immediately after the injury in consequence of blood extravasation veiling the objective sign of the lesion, namely, the depression in the continuity of the structure caused by the tear.

Extensive rupture (sometimes called complete) of the tendon immediately above the patella is rare; I have seen only seven cases. When occurring the diagnosis is obvious, as the almost complete loss of extension power for the time being, and the distinct interval in the region of the tendon, with little but the skin between the finger and the underlying femur, resulting from the retraction of the muscle above, leave no room for doubt.

In two of my cases great distension of the knee-joint followed almost immediately, which is not very remarkable seeing the intimate connection which exists between the tendon and the supra-patellar synovial pouch.

In trivial partial laceration no special treatment is,

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as already said, required, but when the interval in the continuity of the structure is sufficient to admit the finger tip, or greater, immediate suture, unless visceral disease, age, or other considerations render operation unwise, is the ideal, and, indeed, the only rational measure. The lesion having been diagnosed, there is no excuse for delay ; the more complete the laceration the greater is the urgency for direct suture, no matter how wide the interval may be between the torn ends, for there is no doubt whatever that the sooner the severed parts in these cases are brought together the better the result will be, seeing that every moment of delay means increased retraction of the proximal stump, and increased tension upon the suture used in repairing the damage. After operation a splint should be used for twenty-four or forty-eight hours, when the same treatment as that following upon suture in fracture of the patella should be carried out. In cases of obvious laceration, partial or complete, in which for sufficient reason operation has been set aside, treatment on the lines of that advised for fracture of the patella without operation should be followed. Wounds of the quadriceps immediately above the knee may, of course, occur, and it is important to bear in mind that a wound through the quadriceps within two or, perhaps, two and a half inches of the upper end of the patella may enter the supra-patella pouch, and so open the knee-

joint. The only case of this kind which I have seen was that of a butcher, whose knee-joint was laid open in this way by a chopper; the parts were sutured, and no harm came of the accident.

The ligamentum patellæ may be partially or completely torn by muscular action or by great violence in flexing the leg if the thigh muscles are matted about a fracture immediately above the knee, or if the quadriceps has become the seat of traumatic myositis ossificans. Complete laceration is distinctly rare. I can only recall three cases in my experience, and in one of these the tibial tubercle was carried away with the tendon.

The treatment is immediate suture upon the lines laid down in dealing with rupture of the quadriceps extensor tendon. If the tibial tubercle should be separated with the tendon, pinning the detached fragment in position is the obvious indication, assuming, of course, that the health of the patient and other considerations are compatible with the adoption of operative measures.

Division of the tendon by cutting instruments is less serious than a similar injury to the quadriceps tendon, as the joint is not, as a rule, in danger of being opened. Immediate suture on general lines is, of course, the only rational treatment.

CHAPTER XV

EARLY TUBERCULOUS DISEASE OF THE KNEE-JOINT

ALTHOUGH less serious in the true sense than tuberculosis of the hip, the number of cases in which tuberculous disease of the knee is diagnosed—rightly or wrongly—probably exceeds that of any other joint in the body.

In tuberculous disease of the knee, as of other joints, it is essential to put aside the idea, amounting almost to an obsession with some people, that chronicity is an almost certain indication of tubercle—at all events in young subjects. This belief, based upon respectable tradition, without doubt leads to immobilisation being adopted for many cases in which it is as bad for the local condition as it is for the moral state of the patient.

Further, it is far too often assumed that in a patient who has been the subject, especially in the earlier periods of life, of some tuberculous condition, *e. g.* tuberculous adenitis, any subsequent joint swelling should *ipso facto* be of the same nature.

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There is, as a matter of fact, no reason why a chronic traumatic synovitis of the knee, for example, in a subject with a tuberculous history, should necessarily be associated with tuberculosis—a point of much importance, especially in the case of the knee, where so much depends upon retaining the normal mobility in the articulation. The main difficulty in the diagnosis of tuberculous disease in the knee as in other joints is concerned with the early stage.

Later on, when disorganisation has followed, the tibia having become more or less displaced from the femur, and acute starting pains resulting from bone denudation occur, accompanied, perhaps, by softening areas in the thickened synovial apparatus, the result of the breaking down of tuberculous foci, there can be little doubt as to the nature of the case even with the most inexperienced. The earliest stage for clinical purposes is by far the most important, because upon the diagnosis at this period may depend the ultimate integrity—or the reverse—of the limb.

It is to the consideration of this early stage, therefore, that I propose to limit my present remarks.

Given a chronic painless or slightly painful swelling of the knee-joint, is it tuberculous, or is it not?

The correct answer to this question will depend principally upon five considerations :

Age: The relation of age to the incidence of tuberculosis is so much a matter of common knowledge that little need be said about it. It is, however, well to particularly bear in mind that in infancy and early childhood the knee especially is apt to be involved in arthritis due to gonococci, syphilis, scurvy-rickets, and pneumococci, any of which causes may lead to conditions strongly suggestive of tuberculosis. The knee-joint seems to be most commonly affected by this disease between the ages of five and seventeen, the largest number of cases falling to the adolescent period; after this the tendency steadily declines until twenty-five years of age, after which, as a commencing disease, it becomes comparatively rare. I have never seen a case begin between forty-five and sixty years of age, but I have seen three cases which seemed to have commenced at later ages. (2) The elimination by the usual clinical methods of other constitutional factors tending to similar conditions, for example, congenital syphilis, rickets, the quiet effusion of adolescence, osteo-arthritis (so-called). auto-infection from the intestinal canal, etc. (3) The local signs. (4) The result of certain bacteriological and other tests. (5) The effect of treatment.

The constitutional factor.—All other things being equal it may be assumed for clinical purposes that chronic articular changes occurring in subjects the seat of constitutional tendencies of the kind referred to are more likely to be secondary to the

predominant constitutional condition than to any other cause. This possible cause should, therefore, receive the most careful consideration, and unless it can be eliminated, the attribution of the disease to other causes should be made with much reserve, and a final decision should not, as a rule, be made until the treatment of the constitutional or other predominating defect has been exploited successfully, or with failure, as the case may be.

At the same time it cannot be too completely realised that whilst tuberculous disease may occur in a patient the subject of a different predominating constitutional dyscrasia, *e. g.* syphilis, conditions may develop in a patient of a tuberculous type which are in no sense tuberculous in themselves.

The local signs.—In the earliest stage of tuberculous disease of the knee, or, in fact, of any other joint, a differential diagnosis is impossible. It is only by carefully watching the progress of the case that a reliable judgment can be arrived at.

Let us take for an example a case of synovitis following upon injury (typical semi-lunar lesion, and in young people the quiet effusion of adolescence having been excluded) which has either been entirely neglected or has not been seriously taken in hand, for it is in such a case, as a rule, that the question of tuberculous disease comes forward. If the effusion is obvious, rising and falling in amount, increase of heat about the joint being sometimes present and

sometimes absent; when no pain is felt upon bearing weight upon the limb, although some general discomfort or aching may follow exercise; when no thickening of the synovial apparatus is apparent, and the thigh muscles are not unduly wasted, the movement of extension being free, it may safely be concluded for clinical purposes that the case is traumatic, and nothing worse.

If, on the other hand, the effusion be only slight but persistent in degree, the local heat considerable and continuous, the synovial apparatus thickened, with a tendency to veil the normal bony joints, the wasting of the thigh muscles extreme, and last, but not least in importance, if there be reflex contraction of the hamstring tendons rendering complete extension at the knee impossible, the suggestion of tuberculosis is so strong as to amount almost to a certainty.

The effect of treatment.—The possible causes already mentioned having been eliminated, one of the most valuable tests in the treatment of knee-joint affection with reference to tuberculosis, apart from that afforded by the use of vaccines, etc., to which reference will be made later, is the behaviour of the wasted thigh muscles under massage. In synovitis or chronic traumatic changes in arthritis these muscles respond to the stimulus of massage and exercises, recovering in due course something like their normal condition with considerable facility. In

tuberculous cases they respond slowly and reluctantly, the response sometimes being practically *nil*. There is, in my experience, no more important guide to the diagnosis of tuberculosis of the knee-joint than this obstinate behaviour of the wasted thigh muscles, assuming, of course, that no central nerve lesion exists to account for their condition.

Laboratory tests.—Of the conclusive value of the several tests included under this heading, *e. g.* the opsonic index, Calmette's test, the tuberculin (Koch's) test, there is still room for doubt and difference of opinion, a discussion of which would be outside the scope of my present purpose. In any case, no matter what their value may be, I think that at present they should be regarded only as corroborative, and not necessarily conclusive. At all events they should, I am sure, only be taken as of practical value when considered in association with the clinical signs, and not independently. At present there is a tendency to appraise them independently too highly. That the opsonic index, Calmette's reaction, and other tests are valuable as corroborative evidence when carried out with the necessary precision is undeniable, but that local signs are sometimes more important is certain. The following case, the most striking which has recently come under my observation, although not affecting the knee, is useful to show what I mean :

CLINICAL EXAMPLE No. 39.—A girl, aged about

thirteen years, whilst travelling in Switzerland with her parents began to complain of pain in the right foot and ankle, and upon examination some swelling and tenderness along the inner side of the foot was found. As the symptoms became more pronounced and distinct lameness followed, a practitioner of experience was consulted, who referred the patient to a specialist of repute on the Continent. He, having investigated the condition of the foot, and having obtained Calmette's reaction, corroborated by a second test ten days later, pronounced the case as one of tuberculous disease of the foot, and advised eighteen months' immobilisation in plaster-of-Paris.

The patient was brought back to this country with a view to further advice before having the treatment recommended carried into effect. When seen on her arrival the child limped badly and complained of pain, especially when standing, at the inner side and under part of the right foot; a similar pain, but much less, was complained of in the left foot.

Upon examination of the right foot there was undoubtedly some swelling tenderness and pain on standing, over the inner aspect of the tarsus running up into the calf, but it had all the clinical characteristics—and only the characteristics—of a rapidly-increasing flat foot, the foot being of the long thin type, in which the arch is very apt to drop during the adolescent period. The left foot was in

the same condition, but in a much earlier stage. Under such circumstances it did not seem justifiable to adopt the immobilisation treatment. The ordinary treatment for flat-foot, by massage and exercises, was therefore used, with the result that all the aggressive symptoms disappeared, and the child, so far as the feet were concerned, became sound, and did everything that a child could do, the arch of the foot being supported for a time by means of a light metal valgus brace.

Here was a case in which the significance of the local symptoms had clearly been entirely obscured by the importance attached to the Calmette reaction. If the case shows nothing else it is a good demonstration of the desirability of duly weighing the value of local indications before submitting the patient to a treatment dictated by the results of a test, which should only be held to be of assured value when the local signs are corroborative of the existence of the lesion to which the test applies.

The treatment of tuberculosis of the knee in the early stages.—A diagnosis of early tuberculous disease having been arrived at, the first question in reference to treatment is as to the desirability or not of immobilisation of the joint. The general practice is to prescribe a long period of immobilisation when tuberculosis has been diagnosed or is suspected—a proceeding which has the support of long-established tradition upon grounds which are not altogether

clear. Unless absolutely necessary it is manifest that such a line of treatment must be undesirable, since it leads to wasting of the limb generally, which involves the bone structure as well as the soft parts, and, if the joint apparatus is involved in any inflammatory changes, is a distinct invitation to ankylosis, true or false.

At the expense of being thought unorthodox, I believe from my experience that complete immobilisation in the earlier stages of tuberculous joint disease is neither necessary nor, as a routine treatment, wise, and I have little doubt that the later complications from time to time occurring in (presumably) tuberculous cases after long fixation in splints arise mainly from the necessity of adopting the means which are required to rectify stiffness and wasting, caused by the treatment which has been pursued.

For my own part I have come to the belief that the best treatment for the early stage of apparent tuberculosis of the knee-joint is that adopted in sub-acute arthritis following injury, unless there is reason to suppose that the disease originates in the bones, which, for clinical purposes, may be set aside if (1) no lesion is shown by the X rays, (2) if there is no persistent contraction of the hamstring tendons, (3) if no pain is produced by firmly pressing the articular ends of the tibia and femur together, and (4) if no tender spot can be elicited by manipulating the end of the femur, or particularly of the tibia in

the immediate neighbourhood of the joint. The treatment, therefore, which I use is massage and bandage pressure, aided, as a rule, by induced hyperæmia, voluntary movements being allowed and advocated so long as no weight is borne upon the limb, crutch exercise, or the use of a Thomas's splint being encouraged. Associated with these is an open-air life, if possible on the sea, and failing that, at the seaside, excepting in the case of young people born at the seaside, in whom tuberculous affections are generally benefited by a change inland. With this exception sea air is, in my experience, undoubtedly the most important factor in the cure of tuberculous joint disease—it is, in fact, so far as I have seen, as good in its effect as the air of high altitudes is bad, joint diseases, in my experience, generally tending to become worse in high altitudes.

The only restraint to voluntary movement which is necessary in these earliest stages is the use of a ham splint or poroplastic mould at night in order to counteract the inclination to contraction of the hamstring tendons during sleep, and to thus avoid the rather tiresome efforts necessary to straighten the limb on rising in the morning.

The question as to whether the massage and voluntary movement treatment should be continued, or whether the alternative of immobilisation should be resorted to, must be decided by the progress of the case, the three points for consideration in this connection being

the uniform persistence of local heat, the presence of pain on standing, and persistent contraction of the hamstring muscles. Should these symptoms occur in combination, it may be assumed for purposes of treatment that bone disease or cartilage denudation is present, and the immobilisation method should at once be resorted to, but so far as my experience goes the cases requiring immobilisation are exceptional, the number of those in which it is really called for being insignificant.

The use of vaccines and serums in tuberculous joint disease is too large a subject to be dealt with here. It is therefore sufficient for my present purpose to say that whilst their use should be taken advantage of by those who have the facilities at hand for their employment, the treatment by these media, whatever the result may finally prove to be, is not as yet decided enough in its results to justify any relaxation in the application of the various other forms of treatment which are in general use.

So far as the injection of germicidal material (iodoform emulsion, for example) into the joint in cases of tuberculosis in the earlier stages is concerned, my experience has been disappointing. In the class of case met with in private practice I have not found this treatment necessary, and in hospital work I have been unable to assure myself sufficiently that the benefit derived is in any way proportionate to the risks connected with the complications from

excessive reaction which sometimes occur. I have, therefore, discontinued its use.

Of external applications, nightly inunction with vasogen-iodine has been, so far as I have seen, the most helpful; and if immobilisation is decided upon the old-fashioned method of strapping the joint with Scott's dressing (unguent. hydrarg. *ammoniat.*) for the first few months cannot be bettered, supposing, of course, that anything more than mere immobilisation is necessary, which is exceptional.

The common practice of painting the joint with iodine may effect some good purpose by causing a temporary induced-hyperæmia, but the belief, which some seem to have, that constant plastering of the knee, or any other part for the matter of that, with tincture of iodine, leads to absorption of the drug can hardly be regarded seriously. There is, however, reason for thinking that good may in some cases arise from the introduction of iodine by cataphoresis.

Tuberculosis of the patella as a separate factor.—Tuberculous disease of the patella as an independent manifestation is rare; in my whole experience I have seen only two cases. Bearing in mind the exposed position of the bone and its continual liability to slight injuries, its immunity from disease is at first sight a remarkable fact. In reality, however, it only participates in the characteristic of the sesamoid bones generally in being practically free from attacks

of tuberculosis except as an extension of the disease from the joint with which it is in relation.

The initial symptom in the cases which have come under my observation was pain over the patella followed by tenderness and swelling, which was in each case at first thought to be due to pre-patellar bursitis. By degrees the whole patella swelled and presented itself as a hard, craggy mass, strongly suggestive of malignant disease. No effusion into the knee-joint was apparent, but flexion was extremely painful, hence the knee was held stiff in the extended position.

CLINICAL EXAMPLE No. 40.—In one case, that of a boy, aged seventeen years, abscess over the bone developed; upon incision its centre was found to be expanded and hollowed out, containing semi-caseous material which was removed, the surrounding walls of the cavity being afterwards thoroughly scraped and refreshed. Healing, although slow, was uninterrupted, and a good limb, with slight limitation of flexion, resulted, the patella being represented by an irregular mass, apparently of bone.

In the other case—

CLINICAL EXAMPLE No. 41.—Occurring in a woman, aged thirty-six years, the swelling became very large and tender, the skin being bluish in colour, and the parts around greatly infiltrated. The size of the patella seemed to be enormously increased, but the X-rays did not corroborate this impression. Ex-

posure by incision brought into view a large mass, mainly composed of caseous material in the substance of the expanded bone.

The whole disease was cleared out from the inside of the periosteum and perichondrium without opening the knee-joint, which had throughout the course of this case shown no signs of intra-articular abnormality. The wound healed in six weeks, leaving a flattish gristly substance in the place of the patella. Three months later the movements of the knee were free and strong. There was no bony substance to be felt in front of the knee-joint, excepting a few hardish nodules here and there, none of which exceeded the size of a hemp-seed—an interesting fact when considered in relation to defective joints following upon fracture of the patella with wide separation of the fragments.

Tuberculous disease of the bursæ about the knee.—A point of some interest in this matter is the rarity of tuberculosis involving the bursæ having no communication with the joint. In the case of the bursa patellæ this is especially remarkable, having regard to the importance attached by some to the influence of injury as a primary cause of tuberculous disease, inasmuch as this bursa is more exposed to frequent slight injury than any other in the body, with the result that it is frequently the seat of sub-acute or chronic effusion, the best example of which is the common “housemaid’s knee.” In spite of

this, in my experience I have seen only three cases of tuberculosis of the pre-patellar bursa, and I have never seen tuberculosis of any of the other bursæ about the joint which have no communication with it, excepting instances where, in the course of the treatment of advanced tuberculosis, one or more of these bursæ have been laid open, thus leading to direct infection. On the other hand, as would be expected, tuberculous disease of the bursæ communicating with the joint is not unusually seen as an extension of the lesion from the joint itself. The following case seems, however, to show that the incidence of the disease may sometimes be from the bursa to the joint.

CLINICAL EXAMPLE No. 42.—A youth, aged eighteen years, in consequence of a football accident, developed a well-marked distension of the semi-membranosus bursa, to which his attention was first drawn by some slight pain, about a month after the injury. Examination at that time revealed a hard and tense bursa as large as a pigeon's egg. There was no tenderness worth mentioning, but pain followed upon exercise. External treatment having failed to effect any good, the bursa was emptied through a fine opening, the usual semi-gelatinous material being evacuated. It refilled, and removal was advocated, but circumstances led to the suggestion being declined. Twelve months later the patient was seen with typical symptoms of tuberculous disease of the knee-joint,

viz. swelling, without obvious effusion, heat, flexion, and starting pains at night, the bursa being hardly manifest, as it was lost in the general swelling. This is the only case of the kind which has come under my notice. So far as it goes, however, it affords strong evidence in favour of the removal of these bursal swellings when they resist other treatments ; but it should be borne in mind that during the adolescent period they have a singular tendency to disappear spontaneously.

CHAPTER XVI

INDUCED HYPERÆMIA IN THE TREATMENT OF AFFECTIONS OF THE KNEE-JOINT

THE knee-joint is particularly well adapted for the treatment by induced hyperæmia, which has come to be associated with the name of Professor Bier, of Bonn.

Although it cannot be said that the method fulfils all that has been claimed for it, there is, I think, little doubt that the majority of those who have given it a fair trial will agree that within reasonable limits it is a valuable adjunct to the means usually employed in cases of the kind for which it is recommended.

Professor Bier holds that local inflammation is not in itself a disease, but a protective process to fight bacterial invasion. It therefore follows if this contention is accepted as correct, that to attempt the arrest of inflammation is wrong in principle, as, if the fight is successful, it merely aids the cause of the invading bacteria. Hence it is clear that the

use of the ice-bag and other means of applying cold in the early stages of inflammation must, according to this theory, be wrong. The proper course, on the contrary, is to encourage the “redness, swelling, and heat” with a view to increasing the kindly hyperæmia which is necessary in the struggle between the body tissues against the invading bacteria, the spontaneous disappearance of an inflammation being held to mean the defeat of the bacterial host by the increased healthy blood current surging through the parts at the onset of the change.

This helpful hyperæmia can be advantageously fostered by increasing the amount of blood in the part; but it is essential that this should be circulating blood, blood stoppage (stasis) being incompatible with the object in view.

Means of inducing hyperæmia.—The hyperæmia producible is of two kinds: (1) Obstructive, *i. e.* passive or venous hyperæmia; and (2) arterial, or active. The former is produced by the use of an elastic bandage placed around the middle of the thigh; the latter is brought about by the local application of heat, preferably in the form of the hot air or radiant heat bath, this being a similar form of hyperæmia to that produced by the usual hot applications—poultices, fomentations, and the like.

The object of the obstructive method is to charge the affected part with blood by retarding the

effluent flow without producing stasis, in other words the venous circulation must be obstructed to the necessary degree whilst the arteries are left free to pump in their blood stream. Hence, in applying the elastic bandage, the pressure must not be enough to affect the pulse on its distal side.

The degree of pressure exercised is a matter of moment. Using Bier's own words: "The degree of obstructive hyperæmia is a correct one if the patient is not in the least distressed by the pressure of the bandage." If too tightly applied pain will be felt. The whole essence of successful application is the production of hyperæmia without pain. If pain is felt immediately or remotely the constricting bandage is too tight.

When properly applied, the parts beyond the bandage become congested and bluish, or bluish-red in colour, and to the touch they are warm, not cold. Cyanosis, with absence of pulse, is a sign of danger, and should lead to immediate removal of the bandage.

If the obstruction be continued sufficiently long œdema will naturally ensue, but this is of no consequence if it subsides completely after the removal of the bandage. Indeed, temporary œdematous swelling, so long as it is painless and the pulse is not affected, is a favourable factor, but when the obstruction is repeated at intervals sufficient time should be allowed between its applications, to permit

of complete subsidence of the œdema. It is a singular fact that it is not altogether easy to produce an obstructive hyperæmia with much increased heat in a normal or in a tuberculous joint, but the same parts, when involved in acute or subacute inflammation, soon show increase of local heat—a point of importance, as will presently appear.

The existence of abscess is no bar to the treatment by the obstructive bandage, but it should be opened in the ordinary way before the bandage is applied.

“The knife deals with the pus, the hyperæmia treatment fights the bacterial invasion.”

Suction hyperæmia, *i. e.* hyperæmia produced by the use of cupping or exhaustion glasses and other similar contrivances, is also for the most part of an obstructive type, although at its commencement there is active hyperæmia. Here, as in the hyperæmia produced by the bandage, the included area should be red or bluish—never white—since anæmia of the parts means starvation and decreased resistance instead of over-feeding, such as is required in the fight with the bacterial force. Here, again, the pressure must not be enough to produce discomfort; the essence of the method is freedom from pain.

In abscesses or sinuses suction glasses may be employed, and are remarkable for serving a double purpose—the sucking out of the pus, and the produc-

tion of the hyperæmia for dealing with the bacterial invasion. Moreover, they largely obviate the use of drainage-tubes. Their application is made for short periods periodically, all the usual means for obtaining anti- or asepsis being used.

Hot air hyperæmia ; arterial hyperæmia.—This is, of course, a different type of hyperæmia to that produced by obstruction, being the result in the first place of an active determination of blood to the part, as opposed to passive or obstructive engorgement.

It is singularly well adapted for the treatment of chronic thickenings, infiltrations and adhesions when not too old, since absorption is much aided by the flushing of the parts with healthy blood, which occurs in the process. In certain neuralgic and other pains it is of remarkable, although uncertain, benefit. Here, as in the cases of the obstructive bandage and the suction method, no pain or discomfort should be caused by the heat, and in this connection it is most important to bear in mind that with increasing heat the part becomes less and less sensitive; at a heat of 250 or 300 degrees the sensation in a limb is almost *nil*, hence burns may occur without the patient's knowledge—a fact which does not seem to be too familiar even to those who are in the habit of applying this method of treatment.

The hyperæmic treatment in tuberculous disease of the knee-joint.—For the reasons already mentioned I

have long since arrived at the conclusion that the immediate immobilisation of joints suspected of being the seat of tuberculosis, often without any stronger reason than that afforded by chronicity, is practically inefficient and in theory unscientific. I have therefore come to the belief that the rational treatment for the early stages of suspected tuberculous knee-joint disease—unless there is reason to suppose that the disease originates in, or has involved, the bones—is that adopted by most of us, I suppose, in sub-acute or chronic arthritis following injury, viz. massage and bandage pressure, voluntary movements being encouraged so long as no weight is borne upon the limb. In cases of this type the induced hyperæmic treatment has in my experience a double value, therapeutic and diagnostic. Of the comparative rapidity with which obstinate chronic or subacute joint conditions will often recover under the influence of this treatment there is no doubt whatever. I have, for an example, myself seen chronic knee-joint effusion in a young subject, with apparent thickening of the synovial apparatus extending over very long periods, melt away in a few weeks after the methodical application of the obstructive bandage for periods varying from half to two or three hours once or twice daily, and I have also seen in the knee-joint some of the most painful examples of osteo-arthritis with effusion, which have resisted all other treatment, greatly

relieved in a comparatively short time by this means.

At the same time I have met with apparently favourable cases in which the hyperæmic treatment has entirely failed, and in these the symptoms which subsequently developed proved conclusively the disease to be tuberculous. This brings me to the point which I am anxious to emphasise. It is notorious that in spite of all the special tests the diagnosis of early tuberculous disease of joints is most difficult. In fact it is practically impossible, so far as I know, to differentiate, at a certain stage of the disease, between early tuberculosis and sub-acute or chronic inflammation. My experience of the hyperæmic treatment of cases of this type is that, whilst it often acts with singular efficacy in chronic joint inflammation, it is apt to fail in cases in which the condition is tuberculous—a fact of importance from a diagnostic point of view, for it is my belief that, in young subjects of the type likely to be suspected of being tuberculous, the failure of the hyperæmic method, when properly applied, is a strong diagnostic evidence of the lesion being tuberculous. In other words, I am inclined to doubt the curative action of the hyperæmic treatment in tuberculous disease unless it has progressed to the stage of softening, with open abscess or sinus, in which the beneficial effect of the hyperæmic treatment is the result of its help in evacuat-

ing pus, and in dealing with the invasion of various bacteria other than the tubercle bacillus.

It is not, however, as a mere evacuant that the treatment is helpful in cases of this kind, since it actually promotes suppuration, at all events the amount of purulent discharge rapidly increases under its influence, especially in sluggish and inert cases, when the discharges from the sinuses contain very little pus. This is in itself a material advantage, as it is my experience, and, I suppose, it is the experience of others, that in local manifestations of tuberculosis about the trunk and extremities, particularly when the part involved is a joint, the tendency to local cure is greater and the danger of general dissemination less when suppuration is free than when the discharges are mainly serous in character, such, in fact, as would come from granulation tissue, like that occurring in chronic tuberculous disease.

The hyperæmic treatment in stiffness of the knee-joint.
—It is in connection with the treatment of stiffened joints that this method has, in my hands, proved of the greatest use, both as a preventive as well as a curative measure. I am strongly inclined to believe that the tendency to stiffness and to the formation of adhesions in joint affections is less when obstructive hyperæmia is used as an aid to massage or any other treatment which seems desirable, although it certainly will not take the place altogether of the

various other means of treatment in vogue at the present time ; it must, in fact, be regarded as an adjunct, and an excessively useful adjunct, to other treatments.

It will, however, I am sure, be found that in acute conditions, like gonococcal arthritis, acute rheumatic arthritis and the like, that when the hyperæmic treatment can be borne, as it usually can be, in the arterial, if not in the obstructive form, the amount of massage and passive movement subsequently required to restore the normal joint functions is considerably less than when the ordinary methods have been alone pursued.

As an aid in the treatment of joints already stiffened by continued immobilisation, or by adhesions in and around the articulation, provided that these have not become too solidly organised, induced hyperæmia is of undoubted value—a fact in which there is nothing new, as I suppose it is the custom of most people to prepare a stiffened joint for massage by the use of a very hot compress, with a view to what is commonly called “softening the parts,” that is to say, to induce a flow of blood to them. This end is more perfectly attained by the hyperæmic method of Bier than by other means, but care is necessary in selecting the form of application, obstructive or arterial, which is to be used. Speaking generally, if the part is painful, as, for example, in certain cases of stiffening after acute “rheumatic”

arthritis, arterial hyperæmia is, in my experience, more comfortable and efficacious than the obstructive form, especially if there is much thickening of the soft parts about the joint. Similar conditions are suitable for obstructive treatment by the somewhat elaborate exhaustion apparatus invented by Bier for the purpose.

Obstructive hyperæmia, induced by bandage pressure, is by far the most simple and convenient method, and answers well in cases of stiffening of joints without pain, especially if the surrounding induration or œdema is not great. Capital examples of the good results thus obtainable are afforded by cases of stiffness of the fingers (phalangeal joints) so frequently met with after injuries, generally called sprains, but often in reality fractures.

The comparative ease with which in such cases a finger can be manipulated and bent after its base has been encircled by an elastic band for a period varying from fifteen minutes to an hour or more, by which hyperæmia is produced, with the precautions which I have indicated with regard to the avoidance of stasis, is often remarkable, although in common fairness it must be admitted that there is no certainty in this result, as in some cases the effect produced seems to be virtually nothing.

The most striking results of this method of hyperæmic induction have been, in my experience, obtained in stiffness of the knee-joint, in consequence

of the ease with which it can be applied and regulated. One of the most inveterate cases of recurrent stiffness of the knee after successive "breakings down" of the joint which I have seen really showed no hopeful sign of cure until the obstructive hyperæmic method by bandage pressure was adopted, when the tendency to recurrence steadily decreased and a perfect recovery resulted. This case was also remarkable in showing the long period during which obstructive hyperæmia could be tolerated with absolute comfort, five or six hours being a common period, at the end of which general œdema below the bandage was well marked. The application was managed by the patient with much interest.

Of the use of this treatment in suppuration of the knee-joint after an infective wound following upon injury I have had only one experience, and comparing the case with the few others of a similar kind with which I have had to deal, I think I am justified in saying that the course of the case was shorter, its treatment less troublesome, and the result complete recovery—at least as satisfactory as any of the others.

My experience of the use of localised obstructive hyperæmia in dealing with sinuses about the knee by means of modified cupping glasses and similar contrivances is insufficient to justify any useful deductions from it, but judging from the results in the

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very small number of cases in my experience in which suppurating tracts have been thus treated, there is, I think, no doubt that it has a considerable sphere of usefulness in this direction.



